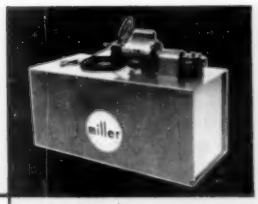
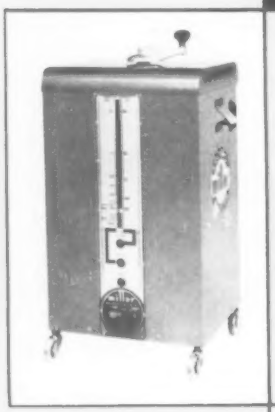
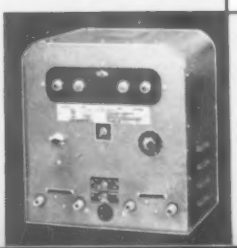
Welding Engineer

PRICE 50 CENTS

JANUARY, 1958







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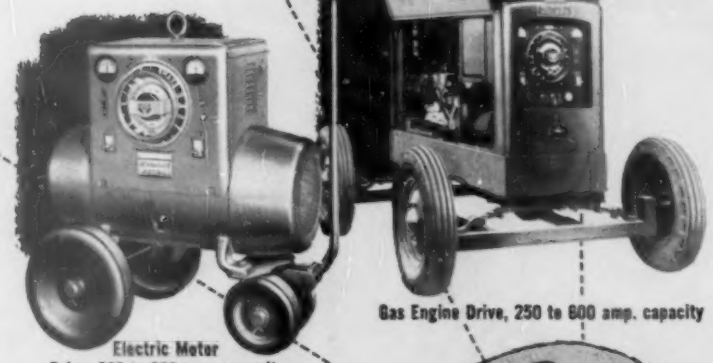

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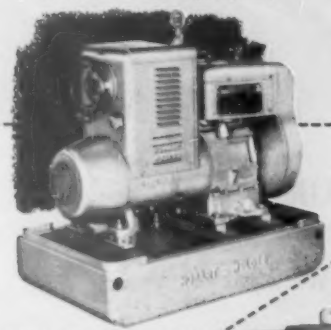

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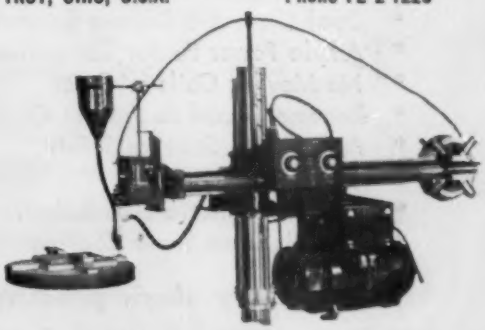

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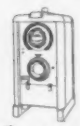
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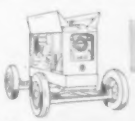
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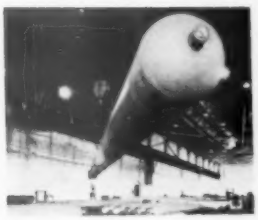
Vol. 43 — No. 1

Welding Engineer

The magazine of joining and severing of materials

This is welding: January, 1958



New demands on gas cylinders are met by reliable welds 27
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Bridge beauty winners—welded! 29
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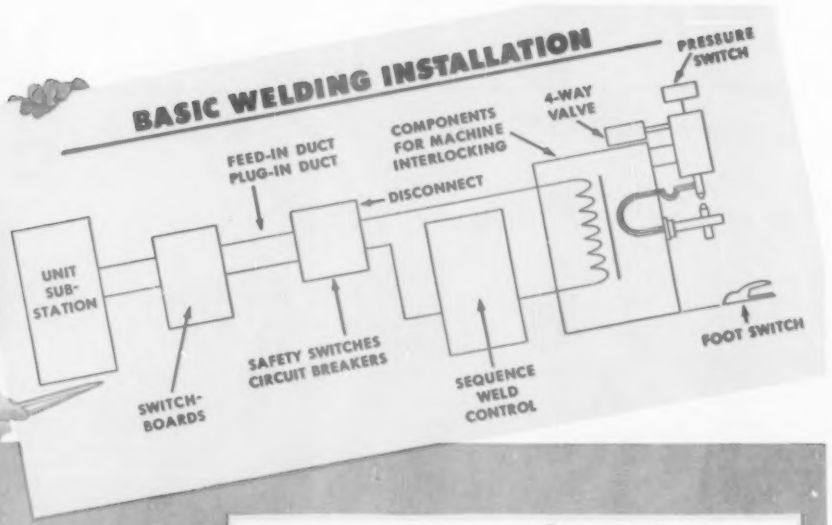

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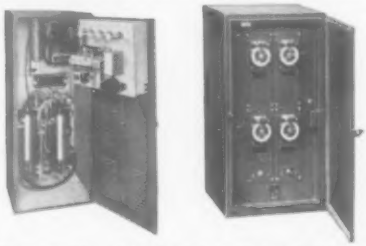

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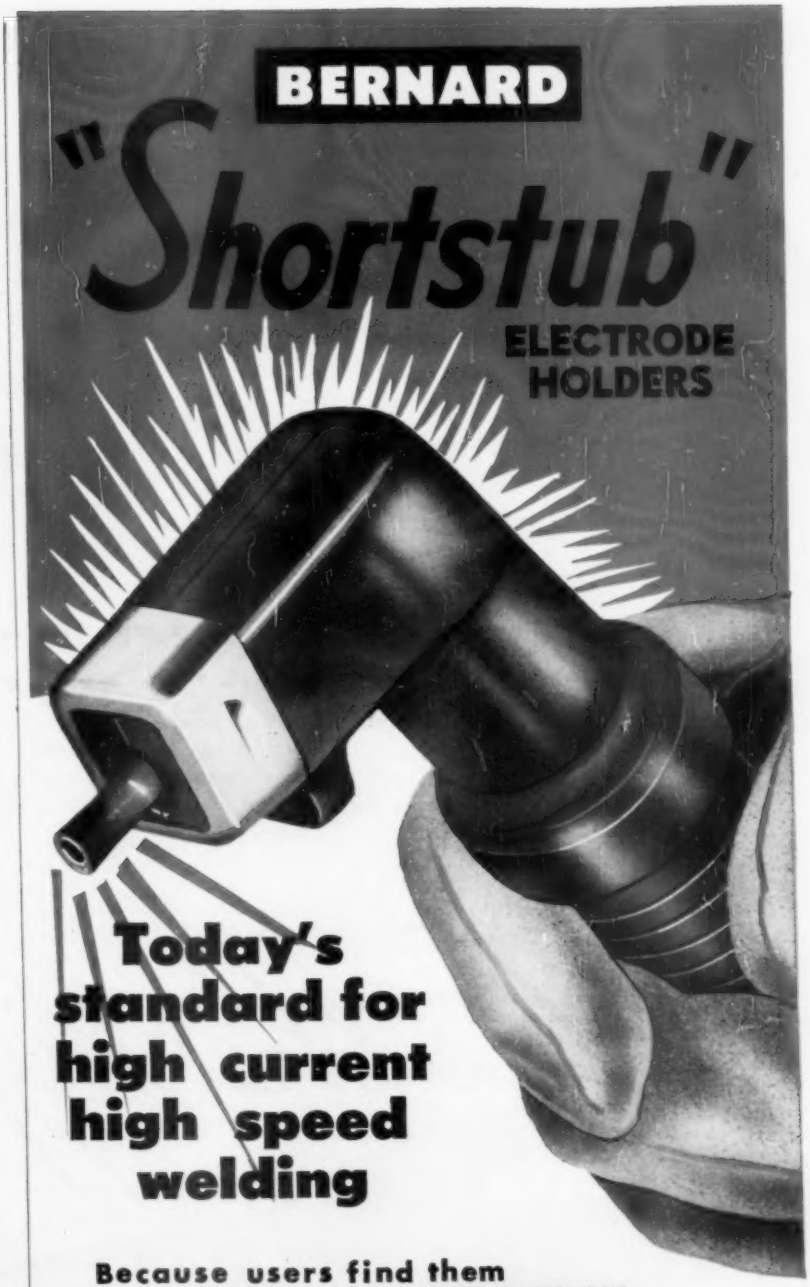

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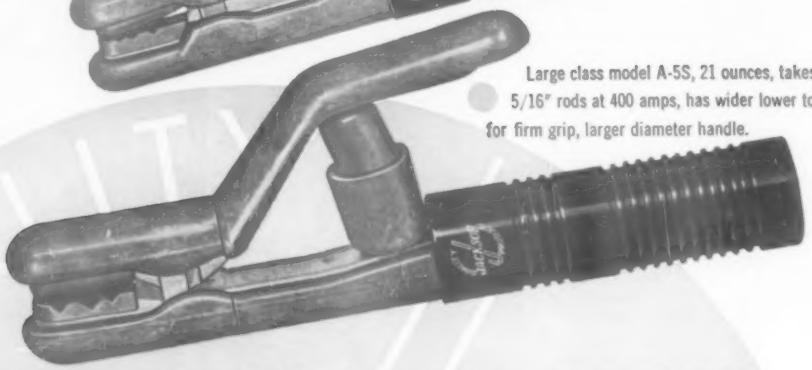

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Medium-class streamlined model JH-3, 15-3/4 ounces, takes 1/4" rods into the tight spots at 300 amperes.

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ABOVE: Welding helps push back Alaskan frontier. Here modern welding equipment is shown in shop of John Handley, a homesteader near Sterling, Alaska.

LEFT: This giant long range stripping shovel won first prize of $5,000 in recent Lincoln Foundation contest for machine design improved by arc welding. Note size of truck against huge "River Queen." (See stories below.)

News

Massive machine wins design award

A 2,400-ton power shovel, taller than a 13-story building and heavier than a Navy destroyer, able to take 80-ton bites of rock and earth, won for Tom Learmont the $5,000 Lincoln award for the design of machines improved through welding. The winning design was for the welded steel base of the "River Queen," built by Bucyrus-Erie, where Learmont works as engineer in charge of quarry and mining excavators. The machine is a special long-range stripping shovel equipped with a 55-cu yd dipper. It is now used at an open-pit coal mine in western Kentucky. Welding saved 22% in weight and 15% on material costs, with a net manufacturing savings of 24%.

A new type of screw press made by Bauer Brothers Co., Springfield, Ohio, won honorable mention in the contest. The machine features a one-piece weldment base for extra strength. The paper describing the "No. 560 Pressafiner" was submitted by M. E. Ginaven and John L. Ostborg.

Stettner stars on TV's "Career"

L. W. Stettner recounts his career at Victor Equipment Co., San Francisco, on the television program "Career," which dramatizes the achievements of men and industry on a nationwide network.

Stettner started in the pioneering days of welding, and his contributions to the industry earned him the International Acetylene Association's James Turner Morehead Medal in 1956.

The 30-minute color and sound film, "Decades of quality and service —the Victor Equipment Co. story," depicts company growth and is being made available for showing to dealers, etc.

Aluminum cranes are all-welded

An all-welded crane now in production for Aluminum Co. of America is made of aluminum, except for moving parts such as gears, wheels, etc. Northern Engineering Works, Detroit, which Mig welds the cranes using argon and helium shields, pioneered in the use of aluminum for overhead cranes.

Aluminum plate used in the box section girders, end trucks and trolley structure is high-strength 5456 alloy. Structural members are fabricated with 6061 alloy. Bolts are either aluminum or stainless steel. All electrical conduit and insulated wire is aluminum. Even the footwalk is built with aluminum plate and has a rolled-in non-slip surface.

Welding helps tame Alaskan frontier

With arc welding equipment, modern pioneers have it all over Daniel Boone. John Handley, a homesteader near Sterling, Alaska (130 miles southwest of Anchorage), uses a Lincoln Electric Co. combination welder and a-c power source driven by an air-cooled engine to help push back the Alaskan frontier. With the machine, he repairs and makes equipment and machinery, powers shop tools and provides electricity for his homestead. The unit furnishes a-c welding current and auxiliary power output of five kva at 110/220 volts.

Carborundum Co. combines divisions

The Carborundum Co. has decided to integrate three of its divisions—the Stupakoff Div., Latrobe, Pa.; Globar Div., Niagara Falls, N.Y., and Refractories Div., Perth Amboy, N.J. The new section will be called the Refractories Div. All personnel, plants and activities (except the "Stupalox" sintered oxide cutting tool project) will be combined. General manager is Boyd M. Johnson, company vice president.

ABOVE: 200-ft single steel tower of bridge will not detract from the beauty of Cologne, Germany's elaborate Gothic cathedral at left, Lincoln Electric says.

RIGHT: New $10 million United Engineering Center, to be built in New York City, will look like this when it is finished in 1960. (See stories below.)

Welded bridge to span Rhine

A single steel tower rises 200 ft from its foundation to support a bridge over the Rhine River at Cologne, Germany. As planned, the tower does not rival the city's pride —the ornate Gothic cathedral. Citizens of Cologne did not want their skyline marred—so the revolutionary concept of a single-tower, or "counterpoint" design fills the least possible amount of skyline.

About 9,250 tons of structural steel, cables, rollers, deck plates, trim and other detail are used in the 2,300-ft span. Much of the bridge is being arc welded, by automatic submerged-arc and manual field erection techniques.

The triangular steel tower carries three pairs of cables which flare out and tie to the span at equi-distant points on either side of the tower. Heavy welded box beams make up the main roadway. The beams carry power, telephone and other cables across the river. The roadway is built up by automatic welding of 49-ft-long deck plates, 19.7 ft wide and 0.39 in. thick. Crossbeams, about 1.2 in. apart and manually welded, support the deck plate.

Traveling AWS show picks St. Louis

St. Louis' Kiel Auditorium will be the scene of the annual American Welding Society show April 15 to 17. During the same week, April 14 to 18, the society will hold its annual technical meeting at the Hotel Statler. An informal welding conference, less technical, will also be held. Plant tours in the St. Louis area will round out the program.

Maximum available exhibit space —33,664 sq ft—will be used. It was virtually sold out at the first announcement, AWS reports. Demonstrations will include actual welding operations of all types. The previous record was set last year in Philadelphia when 32,910 ft of exhibit space was used.

In past years the show has been in Buffalo, Kansas City and Philadelphia. Information will be supplied by Robert T. Kenworthy, AWS Welding Show, Exposition Management, 12 East 41 St., New York 17, N.Y.

Design competition offered by Lincoln

Top award of $1,250 is offered in the James F. Lincoln Arc Welding Foundation's annual mechanical and structural design competition. Forty-six cash awards will be given. The contest is open to undergraduates only, and rewards the best designs of a machine, machine part, structure or structural component which makes a significant use of welding. Designs made as a part of school work may be used. Entries may be submitted after graduation or at the close of the school term. For rules, write the Foundation, Cleveland 17, Ohio.

M&T opens rutile mine

A new mine and ore processing plant has been opened in Hanover County, Va., by Metal & Thermit Corp., New York City. The mine will produce rutile, a material used in the coatings of arc welding electrodes.

Situated on an 800-acre tract of mining land, the processing plant will have a capacity of 100 tons of ore an hour, reports M&T.

"In 1956 nearly 13,000 tons of rutile were consumed in coatings for electrodes. This was more than the total consumption of rutile for all uses five years previously," said H. E. Martin, the firm's president, who also noted that the facility represents a $1,250,000 investment.

U. E. Center to rise in New York City

The American Welding Society is scheduled to be one of 16 engineering societies to headquarter in a new $10 million United Engineering Center to be built on United Nations Plaza, New York City.

Plans call for a 20-story tower surrounded by lower structures. It is scheduled for occupancy in 1960. Included in the building will be an Engineering Societies library and exhibition space where advances in engineering will be interpreted for the general public. An engineering Hall of Fame is being considered. In all, there will be about 250,000 sq ft of floor space.

A fund raising campaign is underway to raise $5 million. The balance will be added by various societies and U. E. Trustee, Inc., funds.

Solar man explains new missile structure

Fabrication of a new type of structure used in aircraft and missile construction will be described by Frank J. Filippi, project liaison engineer for Solar Aircraft Co., at the Midwest Welding Conference, Jan. 29 to 30. Filippi's paper is titled, "Fabrication of brazed honeycomb sandwich panel."

The meeting is sponsored by the Chicago section of the American Welding Society and the Armour Research Foundation of Illinois Institute of Technology. About 300 welding engineers are expected to attend the Chicago meeting.

Other papers to be given are: "Novel production brazing application," by A. M. Setapen, Handy and Harman; "Brittle fracture," P. P. Puzak, U. S. Naval Research Laboratory; "A user reports on T-1 steel," Perry C. Arnold, Chicago Bridge and

(Continued on page 79)

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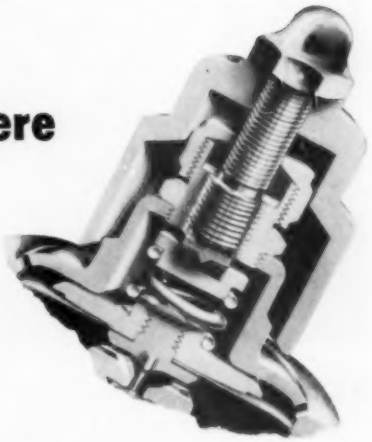

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If you'd like additional specification data or a detailed description of any type welding machine in the new P&H line, write Dept. 307B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

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the HARRIS K-23 does the job QUICKER
A concrete example: A large manufacturer is required to heat (expand) the 7" tie rods on each corner of a large press. Using the oxy-acetylene flame and 2 of the largest torches possible, 2 operators required 2½ hours (total 5 hours); whereas 1 operator, using the Harris Super-Heating K-23 torch did all 4 rods in just 17 minutes.
Harris engineers have designed this equipment for use in low cost cutting and heating operations with less danger of backfire or flashback.
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6290-NFF Series Cutting Tips (0-NFF to 4-NFF inclusive)
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93-SC "Multi-Stage" Oxygen Regulator
HARRIS
LITERALLY, A "PORTABLE-FORGE."
HARRIS CALORIFIC CO.
5501 CASS AVE. • CLEVELAND 2, OHIO

JANUARY
1958

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.

. . NS Savannah, first nuclear-powered merchant ship, will be all welded. New York Shipbuilding Corp., Camden, N. J., will build the ship, while Babcock & Wilcox will supply nuclear propulsion system.

. . Its thermit welding business has been sold by Metal & Thermit Corp. to Reade Mfg. Co., Jersey City.

. .Acting to spike rumors that Westinghouse is getting out of the welding business, officials told WELDING ENGINEER that tale is definitely false. Future looks even brighter than 1957—one of Westinghouse's best years. This year will see introduction of more new products proving that firm is in welding to stay.

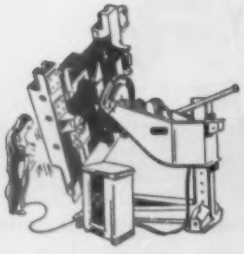
. . Look for electrode prices to go up any day, if they haven't already done so by the time you read this. Industry is finally beginning to realize that it can't absorb rising materials costs.

. . Volume of 1957 resistance welding sales is expected to be about equal with 1955—its second best year. RWMA reports members in first 10 months of last year shipped about $27.5 million worth of machines and equipment.

. . Steel production is falling, with some mills resorting to four-day work weeks. Some are operating at 60 to 65% capacity.

. . Welding should play big role in shipbuilding order—about $100 million—placed by Pittsburgh Steamship Div., U. S. Steel Corp., for Great Lakes ore carriers. Planned are 12 ore ships of from 20,000 to 25,000 tons.

. . Serious recession is predicted for this year by Emerson P. Schmidt, U. S. Chamber of Commerce research director. Other Chamber members foresee an upswing in latter half of year to offset bad first half.



. . Cut backs in mining operations by leading copper producers are seen as move to stabilize declining copper prices.

No. P-2Q SuperGard Safety Cap

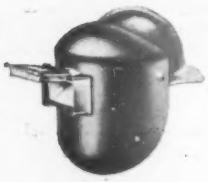
FIBRE-METAL

Quick-Lok®

NEW... RUGGED... POSITIVE...

No. 4706-P-2Q with Insulated Lift Front Glass Holder No. 1096

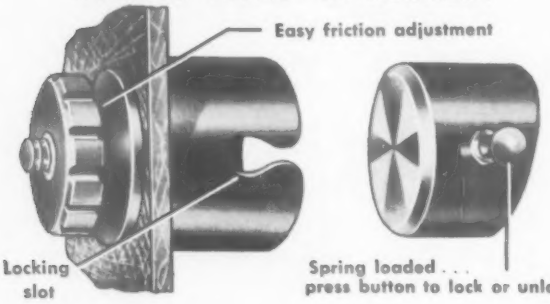
No. 4602-P-2Q with Insulated Steel Glass Holder No. 1085



No. 4890-P-2Q, Fibre shell, curved under chin

No. 4440-P-2Q, Fibre shell, straight bottom

WELDING HELMET ATTACHMENT



Gives you neatest conversion to DOUBLE PROTECTION!

QUICK-LOK is the quickest, newest, connect-disconnect attachment made! Welders *need* head and "back of the neck" protection wherever there is danger of falling or flying objects on the job. Your men *will like* to *wear* this convenient, comfortable combination. For lasting protection, try QUICK-LOK today!

Fibre-Metal offers the QUICK-LOK equipped Helmet-*SuperGard* Combinations shown here (and many others) as well as the No. 4000 QUICK-LOK Kit for field conversion.

SuperGard Safety Caps are of Fiberglas. Helmets are Seamless, Fibre and Fiberglas.

QUICK-LOK FEATURES:

1. Unique, economical, practical.
2. Positive connection, quickly locked or unlocked . . . every time!
3. Properly positions Cap and Helmet for unimpaired vision.
4. No tension or spreading of Helmet . . . reduces breakage.
5. No excessive protrusion on Cap.
6. Completely insulated . . . protected plunger position.
7. All parts easily replaced.
8. Easy friction adjustment on outside of Helmet . . . knurled knob snug to Helmet.
9. QUICK-LOK Kit for "in stock" or field conversion.

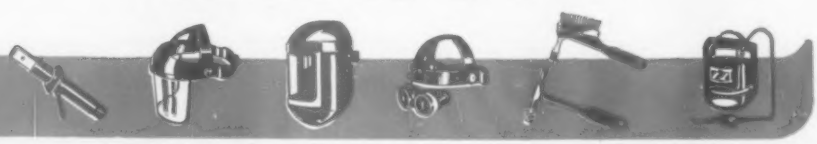
Ask for Bulletin No. 49

THE FIBRE-METAL PRODUCTS COMPANY CHESTER, PENNSYLVANIA

In CANADA: Fibre-Metal "Canada," Ltd., Toronto

THE WORLD'S LARGEST MANUFACTURER OF SUPERIOR PROTECTIVE EQUIPMENT

Sold Everywhere thru Leading Distributors and Dealers



INSULATED EUREKA HOLDERS • FACE SHIELDS • SAFETY HELMETS • HEAD REST GOGGLES • WELD CLEANING HAMMERS • FRESHAIR SYSTEMS

THE ~~479~~ 510 DAY TEST:

it's a RECORD!

We knew they were good . . . the trade knew they were good . . . welding engineers knew they were good. But nobody was prepared to forecast that the new Miller line of GOLD STAR welders would erect a startling milestone in welding history . . . in welder performance!

In August, 1956, Miller began production on a new completely sealed semi-metallic rectifier. The date proved to be significant in welding circles. For ~~370~~ 510 days later **NOT A SINGLE FAILURE HAD BEEN REPORTED FROM THE FIELD!**

A new transformer design teamed with the revolutionary completely sealed semi-metallic rectifier led to the introduction of the Miller GOLD STAR series of rectifier type dc and combination ac-dc machines.

Today, weldors everywhere agree that Miller GOLD STAR machines give you:

a. The best welding current ever produced,
b. Record-making dependability.

The ~~370~~ 510 day test was made on thousands of Miller GOLD STAR welders working under every conceivable condition—indoors—outdoors—in hundreds of industries.

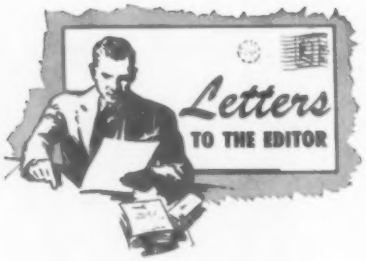
Here indeed is an all-time record for welder and rectifier reliability.

miller ELECTRIC MANUFACTURING CO., INC.

distributed in Canada by CANADIAN LIQUID AIR CO., LTD. Montreal

APPLETON, WISCONSIN

STEEL HANDLE OR
WOOD HANDLE
ATLAS
GIVES YOU
THE BEST!
IT FITS THE HAND
Easier to Grip!
Safer!
FAMOUS ATLAS "DUAL TOOLS"
MODEL AW
MODEL B1W
JUST 2 OF 27 ATLAS MODELS
PROVED PRACTICAL ATLAS WELDING ACCESSORIES
Ask your welding supply dealer to show you the complete Atlas line. Atlas "Tomahawks" and "Dual Tools" are constructed to outlast ordinary weld cleaning tools and actually cost less in the long run. Welders like their "feel" and balance, turn out more and better work with less fatigue.
ATLAS WELDING ACCESSORIES CO.
707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.



Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Shop courses

Fargo, N. D.

Dear Sir:

As always your editorial in the October issue is excellent and very timely. I have been in the welding field as journeyman, supervisor, foreman and instructor for over 35 years and I know only too well the importance of shop courses for engineers.

There is a tendency for engineering schools to drop shop courses. Why? There is no pressure from the welding industry to keep shop courses. We get no suggestions as to how much and what particular phases of shop welding the industry expects us to give. Second, there is the big cost—there are a few firms that give an educational discount but the industry as a whole is definitely against supplying welding machines on a long term basis, the ideal solution to our cost problem.

Our future engineer needs shop welding courses to get a good working knowledge of all phases in welding. He would understand what the man in the shop is up against. The engineer should be able to recognize a good weld, or see the faults in a bad weld. A shop course would also help him to become a better designer.

John H. Forrer
Welding Instructor,
North Dakota State College

July in January

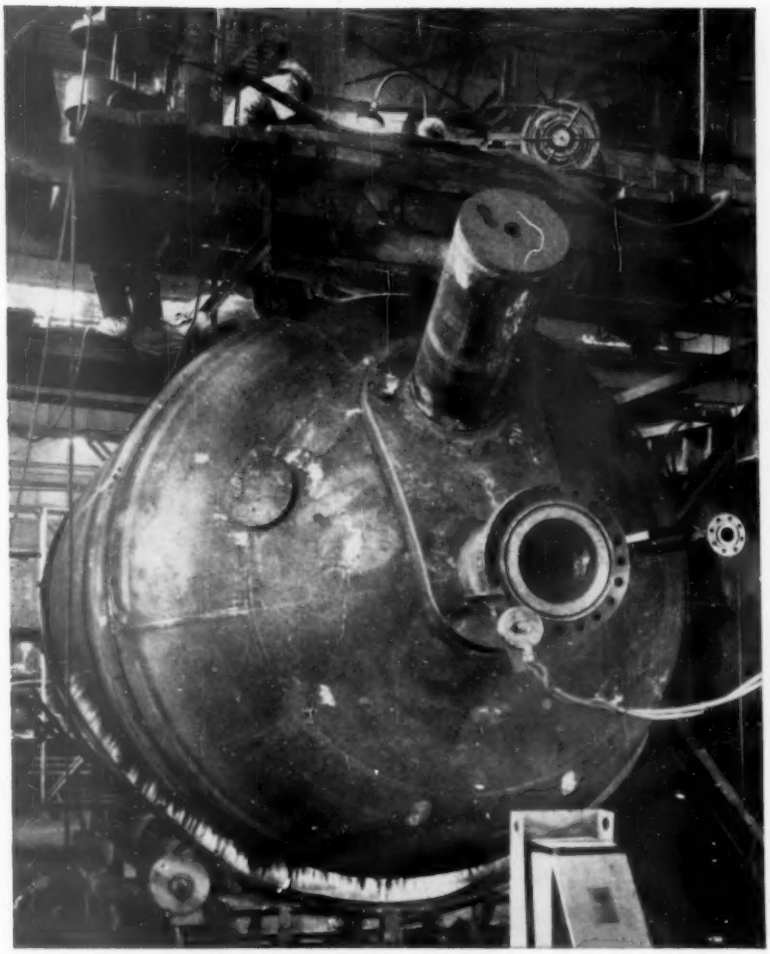
St. Albans, W. Va.

Dear Sir:

Your editorial in the July issue was marvelous. Too bad each member of Congress can't read it!

E. R. Arvidson

—We have sent each member of Congress a copy of the July editorial—see October's *Letters to the Editor*.



When fabrication codes demand 100% X-ray inspection...

SPECIFY *Drawalloy* CORPORATION

Stainless Steel Welding Wire

In hundreds of applications, *Drawalloy* wire has been put to the test . . . X-ray, dye check, pressure and service and with the same consistent result—OK as welded. That's why Frank Iapalucci, Manager of Welding Engineering for Baldwin Lima Hamilton, Eddystone, Penna., selected *Drawalloy* chrome-moly wire for the automatic welds on this reactor. The vessel is constructed of A 301-54T Grade B firebox quality steel ranging in thickness from 5-1/16" to 2-5/8". *Drawalloy* 1-1/4 Cr, 1/2 Mo wire was used for all submerged arc joints.

When inspection by X-ray is required, don't gamble . . . rewelding is expensive . . . specify Drawalloy "quality controlled" wire. *Drawalloy* stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for smooth operation in your equipment and to provide X-ray quality welds.

Why not discuss your stainless welding wire needs with your *Drawalloy* Distributor or Representative . . . a man ready to help you. Bulletin 355-DC provides complete information on every grade of *Drawalloy* wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

DRAWALLOY
CORPORATION
YORK, PENNSYLVANIA

THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL

(PATENT APPLIED FOR)

NEW MANHATTAN SAFETY BACK FLARED CUP

Not simply a new safety "feature" . . . not merely a design "improvement." Here's a *totally new concept* of flared cup wheel design *and* construction . . . developed by Manhattan engineers to give the greatest safety and performance advantages possible for flared cup wheel users. Manhattan's revolutionary SAFETY BACK Flared Cup puts portable wheel *safety* where it counts the most—in *original* strength and breakage resistance!

SAFETY BACK makes obsolete ordinary safety features such as anchor bushings, safety rings, special hub mountings, or revolving cup guards. With SAFETY BACK, steel covers the *entire* back of the flared cup . . . extends down the side to offer a degree of reinforcement and breakage resistance never before possible!

NO OTHER WHEEL—AT ANY PRICE—OFFERS THESE EXCLUSIVE FEATURES

- **Greatest Initial Strength**
- **Highest Safety Factor**
- **Easy Mounting—Easy Operation**
- **Improved Mounting Base**
- **One Piece Assembly**
- **Requires No Adjustment**

Only SAFETY BACK gives you these features—*plus* Manhattan's custom-engineered abrasive bond for *faster* removal of *more* metal on your particular job—at no additional cost! For "More Use per Dollar" in portable grinding operations, you can't get a faster cutting, longer lasting—*safer* wheel than MANHATTAN.

Let a Manhattan abrasive wheel engineer show you the advantages of SAFETY BACK Flared Cups, and other types of Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

RM-752

GRINDING WHEEL INSTITUTE MEMBER

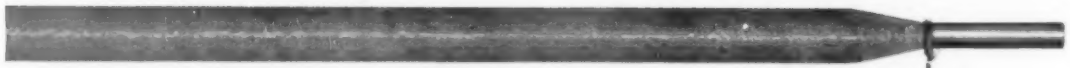
WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

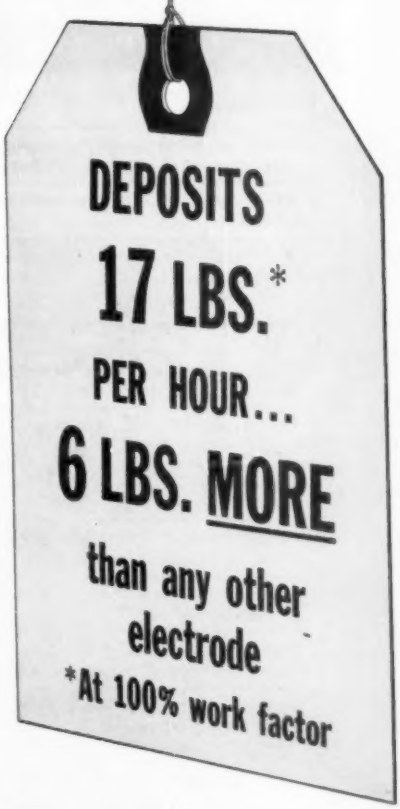
RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

AIRCO ANNOUNCES THE FASTEST ELECTRODE ON THE MARKET



AIRCO EASYARC® 30



This new mild steel electrode—the latest addition to Airco's complete line of electrodes—deposits 17 pounds of metal per hour at 100% work factor—*six pounds faster per hour than yesterday's best.* The extra-heavy iron powder covering permits high machine settings (450 amps AC) for high welding speeds.

Easyarc 30 is designed for making positioned fillets or butt welds. Steady spray-type transfer, easy slag removal. The unusually high deposition rate, together with outstanding X-ray and mechanical properties, makes Easyarc 30 an ideal electrode for high speed welding of pressure vessels, machine bases and structural weldments. Available in ¼" diameter, standard 18" length. Contact your nearest Airco office, or write to address below for complete information and free samples.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

AIRCO

Offices and dealers in most principal cities

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast—
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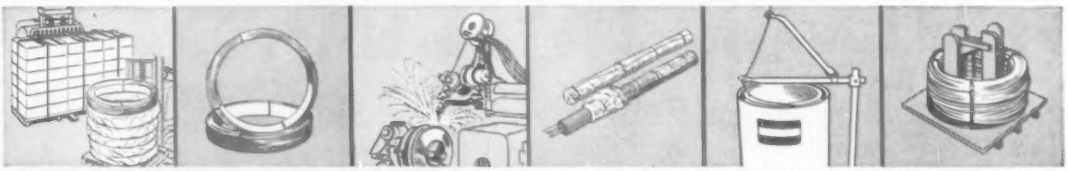
Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetate, alcohols, and other synthetic resins.

PAGE Welding Wire

The RIGHT Packaging for the RIGHT Wire

• When you choose PAGE Welding Wire, you are assured of getting the exact wire for your application—and receiving it packaged to provide maximum protection and convenience. PAGE has developed a packaging program to cover practically every requirement in the broad fields of automatic, semi-automatic and manual welding. Coils, reels, bundles, cartons, Leverpaks, Payoffpaks, Payoff-pallets... PAGE has them all! Look to PAGE for the *right* packaging of the *right* wire.



Wrapped Coils—Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want

PACKAGING ↓ / PAGE WIRE for →	Gas-shielded consumable electrodes: Automatic Welding	Gas-shielded consumable electrodes: Semi-Automatic Welding	Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire: Manual Electric Welding	Straight and cut lengths Bare wire: Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✓	✓	✓	✓		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✓	✓	✓	✓		
120 or 180 lb. (22″/24″ I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✓			✓		
Special coil sizes (on application).	✓	✓	✓	✓		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✓	✓	✓	✓		
Leverpaks, 15″ dia., 25-lb. coils (12″ I.D.x2½″ wide); Leverpaks, 17″ dia. 50/60-lb. coils (12″ I.D.x4″ wide).	✓	✓	✓	✓		
Payoffpaks: 20″ dia. size holds up to 500 lbs.; 23″ dia. size holds up to 700 lbs.	✓	✓		✓		
Payoffpallets, holding 900-1200 lbs. of wire (3/16″ to 3/8″ sizes, incl.) coiled around pedestal on a wooden pallet.				✓		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36″ lengths.			✓			✓
Fibreboard cartons, containing 10 lbs. of rods in 36″ lengths; single or boxed. 50# and over.			✓			✓
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14″ and 18″ lengths.			✓		✓	

33 DIFFERENT ANALYSES

PAGE covers the field of applications with *33 different analyses:* heavy automatic submerged arc..light manual submerged..inert gas manual...automatic, tungsten or metal arc, and oxy-acetylene gas welding.

Look to PAGE for your needs for automatic welding wire, gas welding rods, bare electrodes or metal spray wire.

PROMPT DELIVERY FROM LOCAL STOCKS

PAGE welding wire and rods are available from your nearby PAGE Distributor or PAGE warehouse stocks (*see list at right*).

ACCO for Better Values

Send for These...

- **Folder DH-402A** PAGE Submerged Arc and Inert Gas Welding Wire
- **Booklet DH-1277** PAGE Gas Welding Rods
- **Welding Rod Comparison Chart**

Page Steel and Wire Division ACCO
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

BETWEEN PASSES

our anniversary

With this issue, WELDING ENGINEER begins its 43rd year of continuous publication. That's right, we're 42 years old this month, and still growing. Actually, we trace our beginnings back to 1898, when *The Acetylene Journal* was founded. The *Journal* was later absorbed by *WE*, which even antedates the American Welding Society. *WE* served as the official AWS magazine for several years after the society's founding in 1919.

brain pool

A "free world metal science brainpower pool" has been formed by the American Society for Metals, and the ASM has invited the U. S. government to call upon it in aiding the stepped-up scientific program now confronting the nation. Membership in the pool will consist of leaders of some 20 free-world metal societies represented at the recent 2nd World Metallurgical Congress in Chicago.

unenviable record

Breaking records is something this country does every day, but a new one recently announced by the Internal Revenue leaves us a little cold. Last year, we Americans paid an all-time high of $80,171,971,000 (that's billions) in federal taxes—more than the total revenue collected from 1789 through 1938, and some $5 billion over the 1956 figure. All major classes of taxes contributed to the increase, the largest gains occurring in individual income and employment tax collections.

elected

L. L. McBurney, president of Smith Welding Equipment Corp., Minneapolis, was elected vice president of the National Association of Manufacturers at that group's recent meeting in New York City.

imports

The Copper and Brass Research Association, New York City, recently urged immediate relief for essential industries now being severely hurt by imports. Association Managing Director T. E. Veltfort emphasized that neither brass mill manufacturers nor those in other essential American industries would fear competition with foreign producers if their wage levels were comparable with our own. Relief sought is on an interim quota basis, pending more exhaustive investigation and hearings at which all parties could be heard. The copper and brass people point to a worsening import situation which is bringing 100 million pounds of brass mill products into the United States this year. A random example cited by the Association: imported welding rod is quoted at 16 cents per pound below that made by American companies.

an author

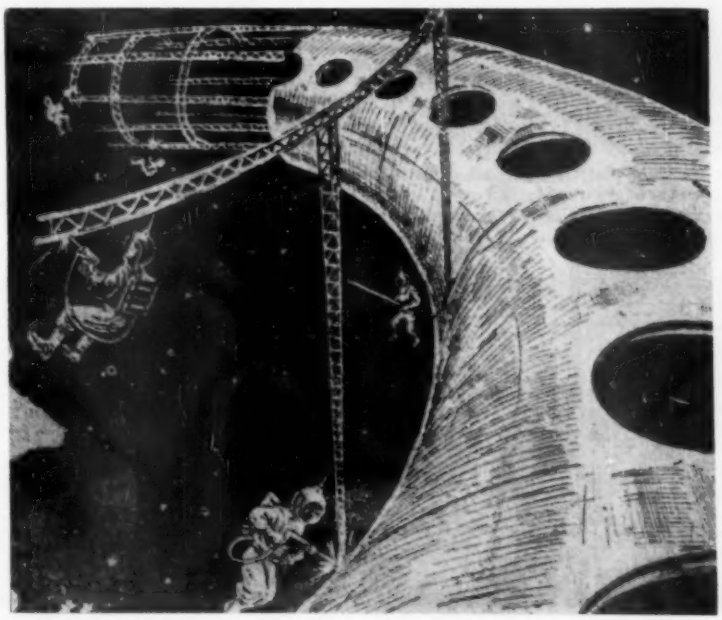
. . . whom we had listed as an M & T man in our November issue was in reality with the customer company, Industrial Welding & Brazing Co., Lansing, Mich. T. W. Campbell co-authored the article, "Broken crankshafts renewed by these welding physicians," with G. R. Van Dreumel, of Metal & Thermit Corp.

in the News

The *Kaiser Aluminum News*, that is. The October issue contained a short article on Paul Leonard's Lenco, Inc., Jackson, Mo., entitled "Magic Wand." Lenco's "Hi-Amp LW-3" electrode holder has aluminum tongs forged at Kaiser's Erie, Pa., forging works.

scientific help

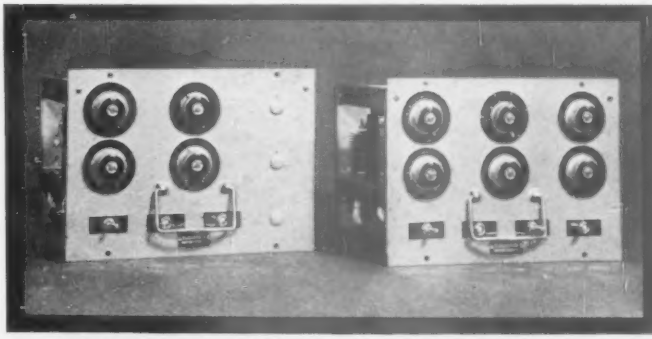
. . . is so badly needed that U. S. corporations are advertising for physicists, metallurgists, etc., in foreign trade publications. An ad in the German *Schweissen und Schneiden* states "those accepted will be assisted in their application for first preference immigration to the U. S. A."

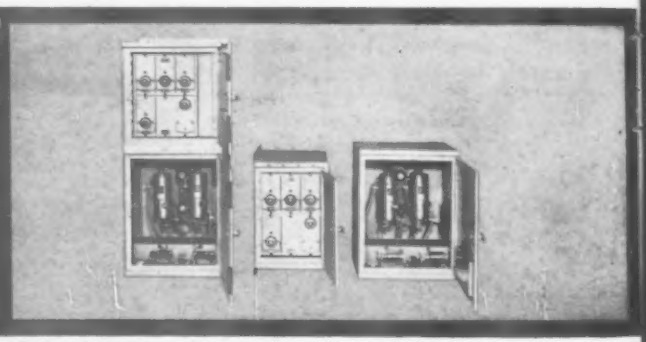


space weldors

Maybe the scene depicted above is not so far in the future as we might have believed before advent of the Sputniks. The sketch is reproduced from a Russian science-fiction magazine and shows weldors suspended in space. They are building a satellite air station. Reminds us of a piece of science fiction authored by Clyde Clason, former managing editor of WELDING ENGINEER. Clyde, in his book "Ark of Venus," described a welding repair on a space ship as it floated in the outer regions.

NEW G-E RESISTANCE-WELDING CONTROLS come in two lines to meet ***any*** non-synchronous application. *Standardline* combinations—using standard NEMA sequence timers—are specifically for normal welding applications. *Customline* combinations use unit timers to provide any control sequence needed on special-purpose, multi-electrode, or automated machines.





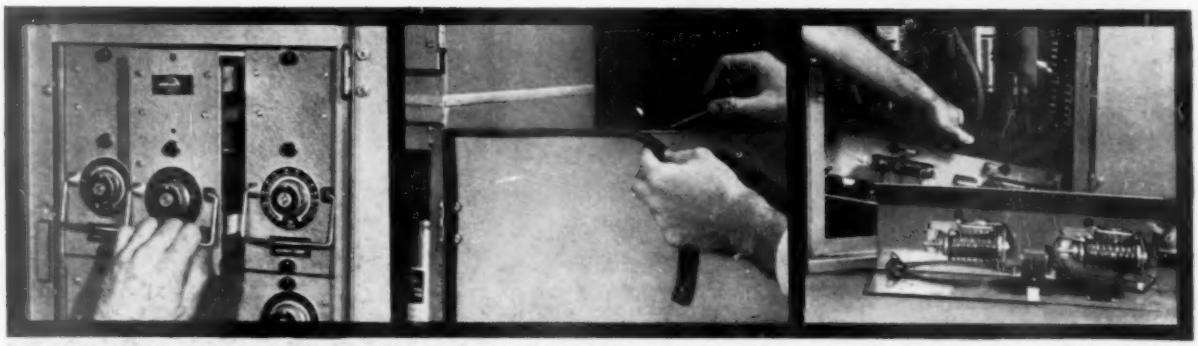
4 **COMPLETE INTERCHANGEABILITY OF 3B AND 5B TIMERS** means instantaneous changeover from spot to pulsation weld-sequence to meet your changing requirements—thus saving time and money.

5 **MOUNTING FLEXIBILITY** permits control and contactor to be combined or separated into functional units as dictated by your own space requirements.

Specify General Electric's NEW *cost-cutting* non-synchronous controls for your next resistance-welding application. For more information, write to Section 794–3, General Electric Co., Schenectady, N. Y., for bulletins GEA-6408 (Standardline) and GEA-6593 (Customline). *Specialty Control Dept., Waynesboro, Virginia.*

7 REASONS WHY GENERAL ELECTRIC'S
NEW NON-SYNCHRONOUS CONTROLS GIVE YOU

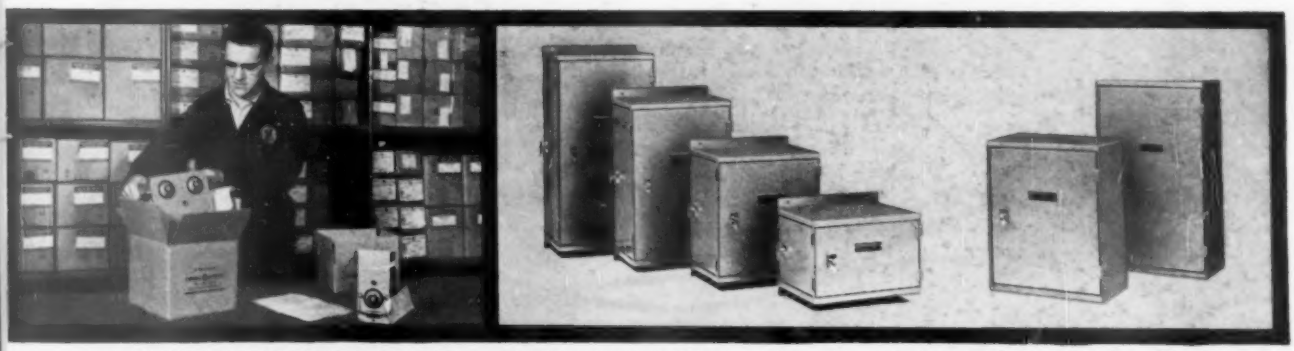
The right combination for your welding jobs!



1 **DRAWER-TYPE PLUG-IN UNITS**—used throughout—provide maximum flexibility, exchangeability of components.

2 **READILY MODIFIED TO JIC** specs with optional kit, enclosures meet or exceed NEMA requirements.

3 **EASY CONVERSION OF SUB-PANELS**—changing from resistors to rectifiers—adds versatility to control.



6 **FUTURE MODIFICATION** of combination is possible since all standard components are warehouse stock items.

7 **FULL-LINE SELECTION**—choice of 4 control cases and 2 contactor cases—means you can buy for present and future needs! "Building-block" design gives maximum flexibility for assembly of combinations, a simple way to add control.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Weldynamics*

* ARC WELDING AT WORK CUTTING COSTS

HOW YOUR NEXT JOB WILL BE HANDLED FOR LESS COST

For lowest cost, Weldynamics indicates that both AC & DC welding currents are needed to take full advantage of today's high-speed electrodes. One machine, Idealarc, fills this need . . . does the work of two welders. As a result, you need fewer machines, work scheduling is simplified, there are fewer machines standing idle.

Lincoln men, trained in Weldynamics, will show you how to apply these cost cutting advantages to your specific jobs—with the latest methods and electrodes available today.

Idealarc 180, 250, 300, 400 and 500 amp sizes. Available as AC or AC/DC welder. Can be purchased with AC only, adding DC later. Operates on single phase power. Write for Bulletins SB-1364 and SB-1343.

The World's Largest Manufacturer of Arc Welding Equipment

LINCOLN

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THE LINCOLN ELECTRIC COMPANY, DEPT. 1737, CLEVELAND 17, OHIO

JANUARY, 1958

Welding Engineer

ESTABLISHED 1916

365 new possibilities

JANUARY, 1958—the start of a new year! An old year is gone, and we fondly hope that it has taken with it the mistakes and outmoded viewpoints of the past. Ahead of us now lies a new year as clean and trackless as fresh-fallen snow. We alone determine the marks to be made.

Given the golden opportunities of a bright new year, how many of us will race over each hurdle to victory? And how many will trip and fall short of the finish line? Before starting the 1958 race, remember that the future depends on all of us—upon the keenness of our minds, the courage of our hearts, and breadth of our vision.

In this age of living from one crisis to the next, our troubled world needs keen minds guided by clear vision. The door is open to all those realistic minds that can grasp facts as they are and deal with them unencumbered by prejudice and superstition—creative minds capable of spawning new ideas . . . conquering new details.

It does not take a sputnik to tell us that unless such minds are permitted to develop and grow, our present technological civilization is doomed as surely as was the cultural life of ancient Greece and Rome.

There is no reason for pessimism or fear. Nowhere in the world has there been more prolific production of creative minds than in the U. S., and this will continue to be the case. But in the building of anything new—products, machines, buildings, or a new world—we must be alert to make the most of possibilities within our grasp. Obviously, this country is not yet making the most of welding.

THIS LACK of knowledge surrounding welding's known advantages—and its unknown potential—cannot be allowed to impede our progress. It is essential that all of us unite to promote welding and its related processes. Have you, for instance, mentioned to anyone that September, 1958, has been earmarked as National Welded Products Month? If not, then it's time you began to *Remember September.*

Proper cooperation in promoting National Welded Products Month will alert the public to welding's importance—and, in many instances, it can awaken industries, too.

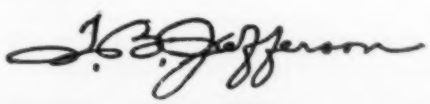
Today, there are proper codes and specifications to cover welding applications of practically every nature. We must inform every construction engineer, every industrial designer, every technical society, every individual employed by a city, state or federal regulatory body of the existence of these codes, and convince them of their authenticity.

BUT SUCH WORK on our part is only the beginning. It's not enough merely to teach engineers the advantages of welding. In technological fields, we must begin far down the line . . . with the student in his first year of engineering school, with the worker in the metal fabricating plant, with every actual or potential draftsman, detailer or designer who has, or is likely to have, anything to do with the preparation of drawings for fabrication.

All of these men must be made fully conversant with the advantages and possibilities afforded by the intelligent use of welding. *Welding will not be used to the fullest extent until this job has been done.*

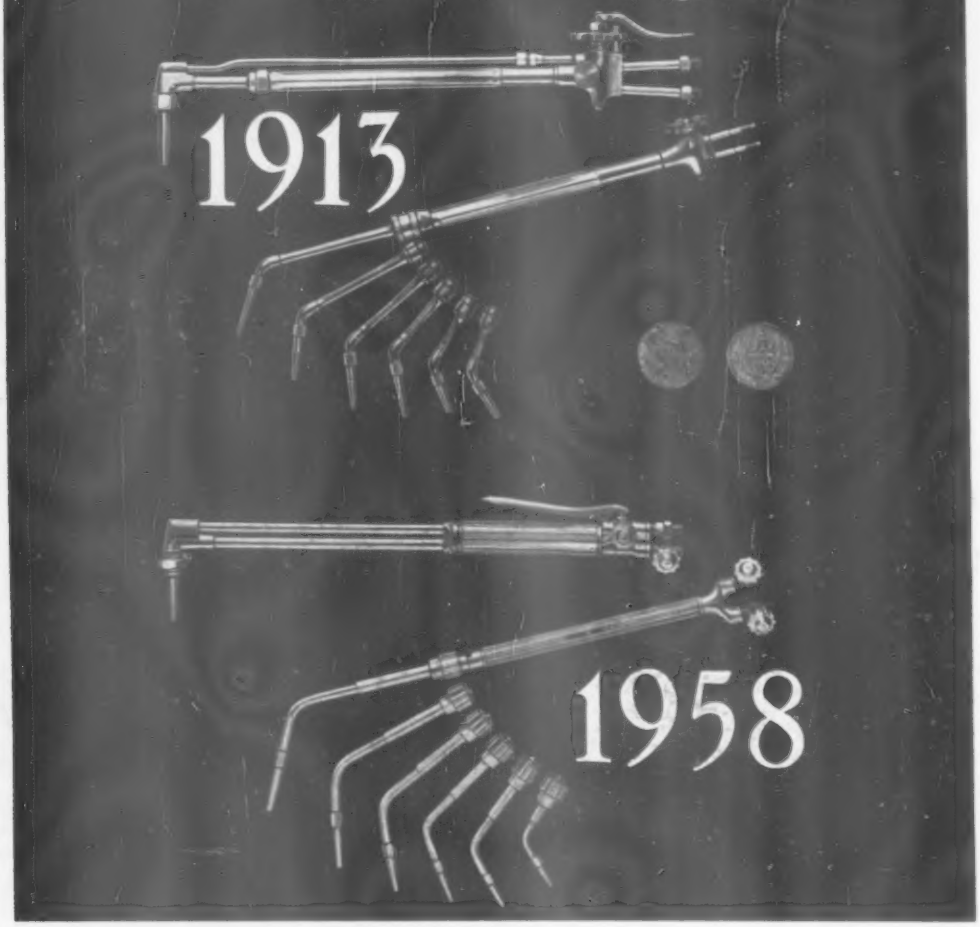
We have made exciting gains in the past—but our greatest opportunities to advance welding's cause still lie in the future. However, there's a massive job of education to be done before *any* opportunity can be fully realized.

Welding has now advanced to the point at which we can truthfully say any metal may be welded if the proper process and proper technique is employed. Let's start by telling the world about that!



VICTOR EQUIPMENT COMPANY

45 Years of Progress



QUALITY . . . SERVICE

the original Victor welding and cutting torches were created in 1913 to fill the need for better and safer equipment—torches that were practical, versatile and built to last—created to be a victor in the field.

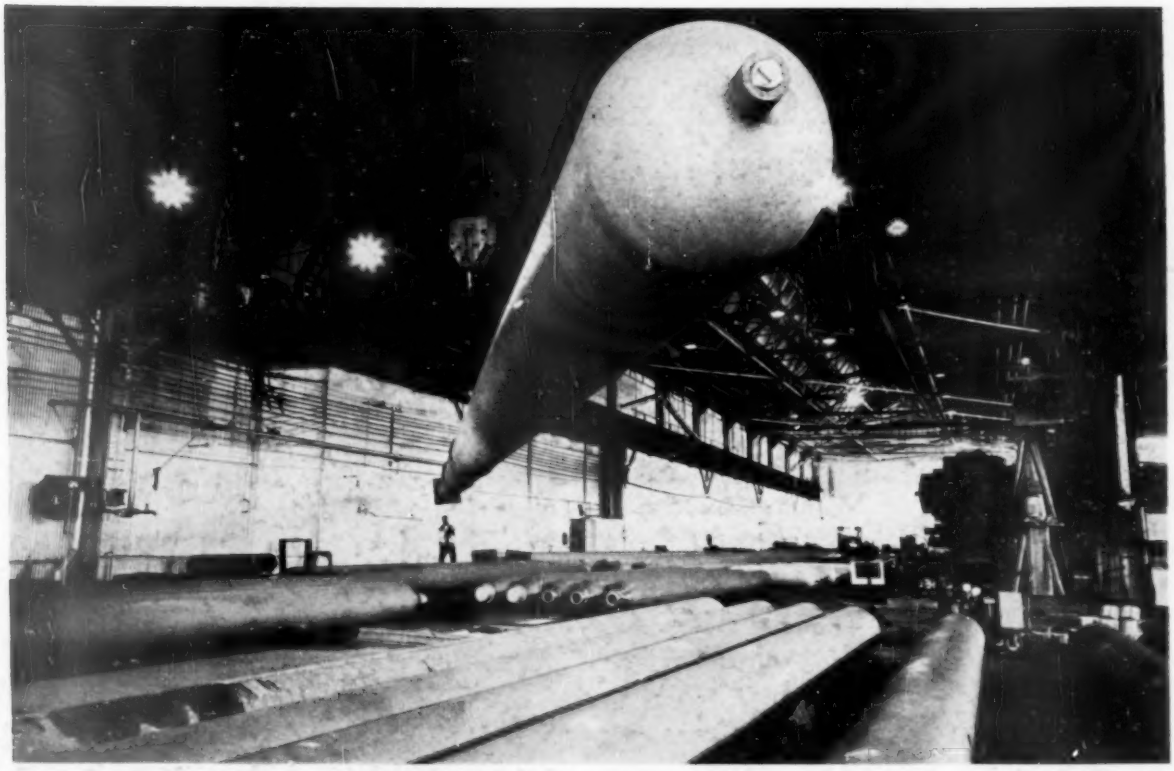
VICTOR for welding

Victor torches were an immediate success—they were designed with the user in mind by L.W. Stettner, a skilled and experienced pioneer welder who knew the needs of the men who work with torches—the design was so efficient and well thought out that few changes have been made since that time.

Victor safety regulators were created in the same pattern—to fill the need for safe, reliable, and practical equipment for the man in the field.

the success and popularity of Victor today is solidly based on the application of those principles under active leadership of the original inventor and founder.

VICTOR EQUIPMENT COMPANY *SAN FRANCISCO LOS ANGELES CHICAGO*



WITH the appearance of a blimp, this 80-ft oxygen cylinder is swung into place with 29 others for shipment from Christy Park Works to an Illinois oxygen plant. LEFT: White-hot billet (2,400 F) is pierced into hollow forging to form rough cylinder for further drawing to desired length, diameter and wall thickness. Sections must often be welded to give needed length.

New demands on gas cylinders are met by reliable welds

FOR MANY YEARS, Christy Park Works of U. S. Steel Corp.'s National Tube Div. has produced seamless steel cylinders for high-pressure storage of gases and chemicals. And they did the job efficiently without the help of welding until modern gases and extraordinary pressure requirements took the lid off once-acceptable standards.

National Tube's cylinders may be made by hot-forming the ends of large-diameter seamless pipe obtained from conventional seamless mills. Where storage requirements of pressure or chemical passivity cannot be met

by normal seamless rolling, however, cylinders are forged from a solid billet or ingot by the pierce-and-draw method, or are cupped and drawn from plate.

Prior to 1950, working pressures of such cylinders seldom exceeded 2,500 psi, and wall thicknesses up to ½ in. were generally adequate. Under these conditions, required volume could normally be obtained from one or more vessels, each formed from a single billet or plate.

Welding Lends a Hand

Largely under the impetus provided by the aircraft industry, cylinder working pressures of 10,000 psi are not uncommon today, and wall thicknesses of several inches may be required. In such cases, the advantages of integrally forged heads with seamless body sections are retained by welding open ends of two or more sections together to obtain required capacity.

Today's ever-increasing pressure requirements are further complicated by the frequent need for strength at low temperatures and for corrosion resistance. Materials to be welded, therefore, range from carbon and low-alloy steel through nickel-bearing and stainless grades.

Fortunately, such highly-developed welding processes as submerged-arc, Mig (metal inert-gas) and Tig (tungsten inert-gas)—together with the quality assurance provided by non-destructive tests—make it possible to weld these steels with the high degree of reliability required. Among the latter tests used are dye penetrant, magnetic particle, ultrasonic reflectoscope and radiographic processes.

Power Sources

Welding power for the manual metal-arc process used extensively throughout the plant consists of transformer, rectifier and motor-generator welders—allowing a wide electrode choice. A dual 600-amp motor-generator set provides up to 1,200 amp for submerged-arc welding, and rectifier units provide power for Tig applications. A 400-amp constant-voltage generator is used for both Mig and semiautomatic submerged-arc welding.

When joint geometry or other reasons dictate the use of manual arc for root passes—or for a complete weld—the joint is positioned for downhand welding and rotated by power-driven turning rolls. If a spherical vessel is involved, a welding positioner is used. Positioning and rotating equipment also serve a valuable purpose during Tig or Mig welding operations.

Welding procedures and weldors are qualified in accordance with Section 9 of the ASME Code for Unfired Pressure Vessels or, in the case of military work, with the applicable MIL specification.

Mainly Submerged-Arc

The major portion of welding on the steel cylinders is done with the automatic submerged-arc process. A welding head and all necessary accessories are usually mounted on a ram-type manipulator which may be positioned over one set of turning rolls, or rotated 180 deg to handle work on a second set of rolls or a welding positioner.

Semiautomatic submerged-arc equipment frequently welds external fittings and mounting accessories.

National Tube's edge-beveling procedures prior to welding are typical of those in general use—with the possible exception of somewhat general radii and spacing at the root. Beveling, together with machining of inside surfaces so that back-up rings fit neatly—and meticulous cleanliness during the total fit-up operation—assures adequate penetration and root-pass quality.

WORKER installs thread protectors on giant cylinders. Some cylinder types have 3-in. wall thicknesses and can contain pressures up to 10,000 psi.

When design considerations do not permit inclusion of a back-up ring, the joint is assembled with a consumable insert ring which is fused with a Tig gun to form the root pass. Sufficient manual metal-arc welding then follows to permit finishing the weld with either the Mig or submerged-arc process.

Uniform Content Assured

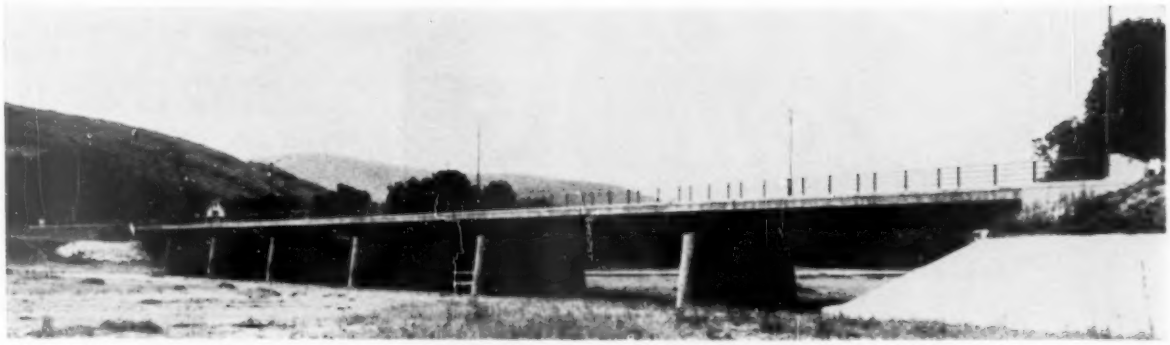
Submerged-arc welding is utilized to join carbon, low-alloy and nickel steels where low-temperature service is specified. On the latter steels, a ⅛ or 5/32-in.-diameter low-carbon wire is used.

Since physical properties of parent metal—including low-temperature impact strength—must also be met by the weld, definite current and voltages are established. They must then be carefully maintained to assure uniform alloy content in deposited weld metal. Typical values for this work are 28 arc volts and a 450-amp current.

The more critical alloys and stainless steels are usually fitted with a consumable insert ring, and the interior of the vessel is purged with an inert gas. The ring is then fused with a Tig gun, and the Mig process takes over to complete the weld.

When material to be welded is susceptible to such a root-pass fault as cracking, the initial pass is checked by dye penetrants—or radiographed if necessary—before work continues. Completed pressure welds are inspected on a 100% basis with appropriate radioactive isotopes.

If no weld repairs are necessary—and they are rarely required—the completed vessel is hydrostatically tested in excess of its rated working pressure.

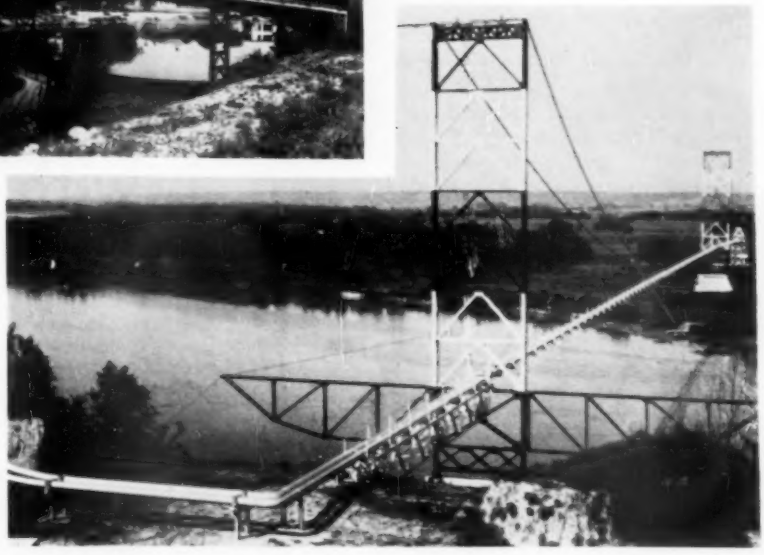


▲ JUDGES praised the "simplicity and straight forward expression," of the Allegheny River Bridge in Salamanca, N. Y. The bridge won first in its category, costing less than $500,000.

Bridge beauty winners—welded!

Here are four welded winners in the American Institute of Steel Construction's 29th Annual Aesthetic Bridge Competition.

← PICTURESQUE Corporal Joseph Thompson Memorial Bridge in Watertown, Mass., won honorable mention in Class III.



"BEST of show," judges said, → was this pipeline bridge. Winner in Class I, bridges with spans of 400 ft or more, the Missouri River Pipeline Suspension Bridge is in Plattsmouth, Neb. "An outstanding example of an abstract design for a utilitarian purpose," judges declared. "For its light load it is beautifully proportioned." Welding played its part in this beauty's bounty.

▼ BUFFALO Bayou bridges in Houston, Texas, won Class II for bridges with spans under 400 ft, costing over $500,000. Designed and built by the Texas Highway Dept., the curvature of the long span appealed to the jury "for its feeling of lightness and grace."

BEAUTY CONTESTS have long been a study of classic line, fine proportion and well-placed curves. Recently a contest was held that included these criteria—plus a few more. From 70 entries, nine bridges were chosen as the most beautiful in the country opened to traffic in 1956; many of them were welded.

The 29th Annual Aesthetic Bridge Competition, sponsored by the American Institute of Steel Construction, judged man's talent, his ingenuity, his ability to overcome problems. The judges—architects and artists—saw tons of steel and concrete fashioned into fragile-looking spans, strong enough to hold thousands of tons. The jury praised today's bridge designers for simple and direct solutions, good taste and excellent handling of problems.

Winners were divided into three classes, according to length of span and cost. The winner in each class will sport a stainless steel plaque, and designers of other winners received honorable mention certificates.

You can have uniform fillets like these when

dip brazing aluminum with paste filler

By A. M. Setapen
Handy & Harman

THE TREMENDOUS increase in the use of aluminum for industrial and military products is accompanied by a series of advances in joining techniques for this metal. One of the most useful of these techniques is brazing, which offers the unique combination of high production, precision and versatility.

Brazed joints can be made at points that would be inaccessible to mechanical fastenings, and from one to several dozen joints can be brazed simultaneously. The brazed structure has good stress distribution and fatigue resistance because of the continuous filleted joints provided by filler metal.

The brazing process is conducted at relatively low temperatures, keeping fixture and part distortion to a minimum, particularly valuable in light-gage parts. The final brazed structure is all aluminum, the joints having the same corrosion resistance as the parent metals.

Virtually every type of heating method used in brazing ferrous metals has also been applied to aluminum. These include brazing by furnace, salt-bath dip, open flame (either by hand-torch or gas-fired machines), induction, block and metal dip. Each method has one common element which often requires excessive assembly time and at times affects the uniformity of joint quality.

Except in the case of hand-torch and metal dip brazing, this factor is the need for preplacing filler metal preforms in the joint during assembly.

Powdered Alloy

In assemblies having long, numerous or irregularly shaped joints, much of the assembly time is devoted to secure and accurate preplacing of the filler metal preforms so the entire joint will be brazed. Development of clad-brazed sheet has, to some extent, alleviated the assembly problem, but only at the cost of using filler metal in sections where it serves no useful function.

Recent development of a powdered aluminum filler metal, applied as an aqueous paste to the joint area and brazed in a flux bath, has decreased excessive assembly time and has substantially increased production joint uniformity. Called "Alumibraze," this aluminum filler metal has been used for production brazing for almost two years at the Glenn L. Martin Co., where it reduced assembly time as much as 95% for certain complex parts.

The use of this alloy also has produced several additional advantages:

(1) Tensile strengths of up to 45,000 psi have been obtained in joints of 1/16-in. gap in Type 6061 aluminum.

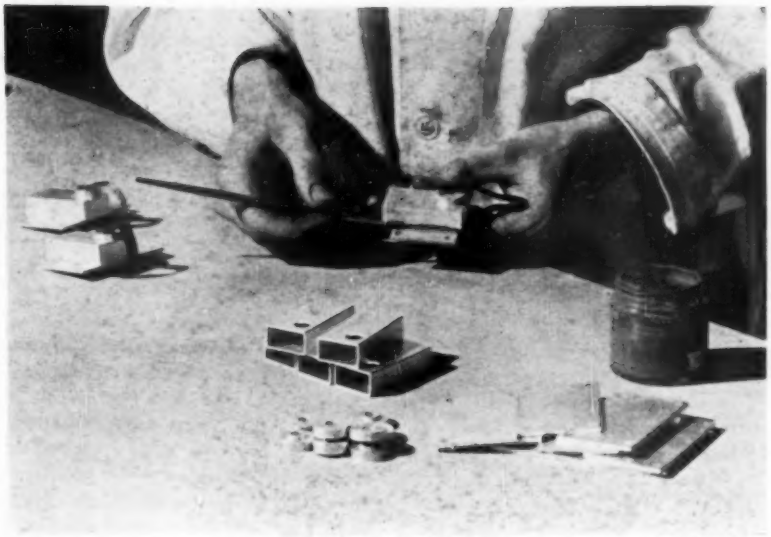
(2) There is very little waste since the filler metal is applied only where and in the quantity needed. During brazing, the filler metal does not spread outside the joint area, but wets and bonds only those areas to which it has been applied.

(3) The fillets are small, uniform and in many respects superior to those produced by the conventional

preforms of clad-brazed sheet. Little, if any, mechanical clean-up is required.

(4) The filler metal can be applied, usually after the parts are assembled, to almost any part shape or joint location that can be reached with an applicator, and in many places where the use of preforms would be difficult.

(5) The process, conducted in a molten flux bath, practically eliminates distortion problems caused by uneven heating, since all assembly and fixture parts are heated to brazing temperature almost simultaneously. Dip brazing also provides a quick method for producing multiple joints in a single part or in a large number of small parts at the same time.



FILLER metal paste is easily applied by brushing it along the joint, usually after the parts are assembled. Note the simple spring members used for fixturing.

How Filler Works

This new filler metal is an aluminum-silicon eutectic consisting of 88% aluminum and 12% silicon (AWS designation BA1Si-4), and melts between 1070-1080 F. Supplied as a powder in combination with a controlled amount of a flux-cement it is made up into an aqueous paste, coated directly onto the joint area.

When the slurry is dried, the flux-cement acts as a binder which holds the filler metal in place at the joint. The characteristics of flux-cement are the key to the process. The binder does not melt at the usual brazing temperatures, but is soluble in the flux.

When the assembly is dipped into the flux bath, the binder dissolves, permitting the molten filler metal to flow and distribute itself through the joint by capillary action and form a bond by wetting the parent metals. A fillet is produced by using a slight excess of filler metal.

Filler Paste Uses

To date the paste has been used with more than a dozen wrought alloys including types EC, 1100, 3003, 5050, 5052, 5056, 5254, 6053, 6061, 6062, 6063, 6066, X2219 and X5356, as well as several cast alloys. Optimum joint clearances are almost the same as those for silver brazing; i.e., 0.002 to 0.006 in. for maximum strength. On precision assemblies, such as radar plumbing, a tolerance of $\pm$0.002 in. is typical.

On certain types of joints, notably the longer lap joints, tolerances of 0.010 in. and larger may be required to fill the joint area. Almost any conventional type of joint suitable for brazing can be used, except straight butt joints. Tight fits should be avoided since they may interfere with the flow and distribution of the molten filler metal into the joint.

How To Do It

Dip brazing with this aluminum filler metal consists of six basic steps: cleaning; assembly; application of the alloys; preheating; dip brazing and flux removal.

Parts should be deburred and cleaned before attempting to braze them. All oil and grease must be removed. When working with the non-heat-treatable alloys, vapor or solvent cleaning will usually do the job; for example, a trichlorethylene vapor followed by a 45-second dip in a detergent-type cleaner and water rinse.

When working with the heat-treatable alloys, etch-type cleaning in acid or caustic is usually necessary to remove the more tenacious oxide forming on these alloys. A typical chemical cleaning method consists of a 50% nitric acid bath followed by one of the several proprietary oxide-removing cleaners and then a hot water rinse.

For a persistent oxide scale, a caustic treatment may be required. This consists of immersing the parts in a 5% solution of sodium hydroxide at 150 F for 30-60 seconds followed by a cold water rinse. This is followed by a 10-20 second dip in cold 50% nitric acid and then a cold and/or hot water rinse. When tolerances are critical, allowances must be made for the metal dissolved in these pre-cleaning and later post-brazing clean-up baths.

Oxides can also be removed mechanically with steel wool, an abrasive belt or a 6-in. powered brush having stainless steel bristles 0.02 to 0.005 in. in diameter, and rotating between 1800 and 3600 rpm.

Parts should be brazed within 48 hours after cleaning and always stored carefully to prevent recontamination.

Assembly And Fixturing

The parts are assembled in a manner dictated by the joint design and configuration of the individual parts. Insofar as possible, all parts should be self-locating so that they can be staked, tack or spot welded during assembly, simplifying the holding fixture design.

Fixture design plays an important part in the success and economy of any dip brazing process. Fixtures designed so that the molten flux will run off rapidly will reduce the amount of flux adhering to the fixture and parts after removal from the bath, and will reduce the amount of flux loss. All assemblies must be vented and ported to permit air expansion and rapid flux drainage.

Avoid using screws and bolts as

hold-down devices since the flux will solidify in the threads and will be troublesome to remove. Generally, springs are the most useful hold-down devices because they produce a positive holding action yet enable the parts to expand under heat without distortion.

If the hold-down pressure is applied over a relatively small area, the aluminum part should be protected from marring by stainless steel shims or spacers between the surface and clamping device.

The mass of the fixture should be as light as possible, consistent with adequate strength and dimensional stability, to minimize heat absorption from the flux bath.

Fixtures are usually fabricated from high-heat resistant alloys such as Inconel-X, half-hard 301 stainless steel or their equivalents. Steels such as 1025, 4130 and the like, should not be used because they react with the flux and produce scale which contaminates the flux bath.

For coil springs, music wire is acceptable. However, use Inconel-X or equivalent for flat springs. Type 301 half-hard stainless steel can be substituted for the Inconel, but it will have substantially shorter service life.

Applying Filler Metal

The filler metal is prepared by adding enough water to produce a thick but workable paste. If the paste is too thin, do not pour off the excess water but thicken with additional powder, or some of the water soluble flux will be lost. The paste tends to settle out upon standing, hence, it should be thoroughly stirred to maintain uniform dispersion before application.

It can be applied with a stick, spatula, glass rod, small brush or even a syringe, depending on the shape of the part and the quantity required. Drag the applicator along the joint, depositing enough alloy to produce a satisfactory braze and fillet. The proper amount can usually be gaged after a few trial runs.

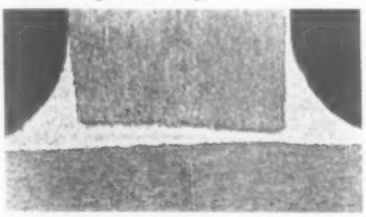
The parts and fixture must be preheated to nearly brazing temperature, accomplishing three things. It dehydrates the assembly, preventing instant steam formation in the flux bath. It "sets" the flux-cement which binds the filler metal firmly in place. By being close to brazing temperature, the parts can be brazed with a minimum dwell time in the flux and with minimum heat drain from the bath.

Preheating is done in a circulating air oven, maintained at 1,000 F. The preheat period depends on the length of time needed to bring parts and fixtures up to temperature, and is governed by the mass of metal involved.

Dip Brazing

The brazing bath should be a dip brazing flux maintained at 1,100 F $\pm$ 5 F. The assemblies are dipped directly into the bath immediately upon removal from the preheating oven to prevent any appreciable cooling. If the parts are too cool, the flux may solidify on contact, clog small openings and prevent the filler metal from flowing readily. The usual brazing time is from one to three minutes depending on the mass of the assembly.

Whenever possible, the dwell time should not exceed three minutes since excessive alloying between the filler metal and the base metal will occur. Higher strength aluminum alloys are relatively more susceptible to this alloying and require particular care against over-long immersion in the flux.



JOINT made with the filler metal paste in ¼-in. thick 61S-T6 aluminum alloy. Note excellent penetration and uniformity of fillets. Magnification is 14 times.

The bath itself should have a ceramic liner and should be electrically heated by nickel immersion heaters. These materials are necessary since the flux is highly reactive with ordinary steel. Procedures for handling and maintaining the flux are about the same as for all aluminum fluxes.

Flux Removal

The final step is the complete removal of flux from the assembly. A preliminary immersion in boiling water to remove as much flux as possible is followed by an appropriate clean-up treatment. After the assembly is removed from the brazing bath, it should air-cool sufficiently to solidify the filler metal so that the joint can withstand the stress imposed by the thermal shock of the quench.

The quench should preferably be done in an overflow tank to control the flux concentration in the wash water. A pressure spray of manual brushing is helpful in dislodging flux from accessible joints.

Following the boiling water rinse, one of several acid treatments may be used to remove residual brazing flux, the choice depending on the character of the brazed parts and the extent of cleaning required.

These treatments may be: a 30% nitric acid bath at room temperature for 10 to 15 minutes; a hydrofluoric acid bath at room temperature for 5 to 10 minutes followed by a rinse and a nitric acid dip; or a nitric acid-sodium dichromate bath at 150 F for 5 to 10 minutes.

In all cases, after the acid baths the parts should be thoroughly rinsed in one or two baths of clean water and then dried. Agitation and turbulence improve the efficiency of any flux removal treatment, minimize the required immersion time and reduce the possibility of attack on the aluminum parts.

Test For Cleanliness

It is best to check for complete flux removal, since any remaining flux will react with the aluminum assembly. A convenient test is to place a drop of 5% silver nitrate solution on the cleaned and rinsed part. If any brazing salt remains, a white silver-chloride precipitate will form in the drop.

Because of the smooth uniform fillets produced, little mechanical treatment is required before final finishing. Since the brazing is conducted at temperatures higher than the annealing temperatures for aluminum alloys, assemblies brazed from non-heat-treated alloys will have mechanical properties equivalent to an annealed temper. The heat-treatable alloys are also annealed by brazing, but most of this strength can be regained either by a heat treating operation after the parts are brazed or by quenching from brazing temperature.

Consult the manufacturer of the aluminum alloy for specific procedures if it is necessary to heat-treat the assembly as a separate operation after the parts have fully cooled.

In a semi-automated line . . .

Seam welding paces high-speed drum fabrication

IN THE VAST JUNGLE of piping and pressure vessels that constitutes much of Dow Chemical Co.'s Midland (Mich.) Div., automation in chemical processing represents the only feasible means of achieving operational economy and control.

And along with the firm's many push-button installations—naturally—go valuable welding procedures, some of which are also part of semi-automated set-ups.

Helping Dow keep pace with ever-increasing material handling demands (many tons of chemicals are shipped each day from Midland) is the resistance seam welder shown in the photo sequence on this page. It is an integral part of a high-speed fabrication line that can turn out approximately 280 chemical containers every hour.

Grit Blasting

At the head of this assembly line, 37 by 66-in. sheets of 24-gage cold-rolled steel are fed by hand onto an L-shaped work table. Each sheet is then mechanically grasped and pulled into line with a vacuum grit-blasting unit.

Flexible hoses from this machine are fixed to both sides of the table and thoroughly clean two edges of the passing sheet.

At the end of the first leg of the "L", sheets are pulled sideways and travel a few feet to the welding machine. Underneath the upper arm of this 200-kva unit the sheets are quickly rolled into a loose circumferential shape. Then, just before the circular electrodes grasp the work, cleaned edges are overlapped ⅛ in. by two concave forming rolls (*see photo*).

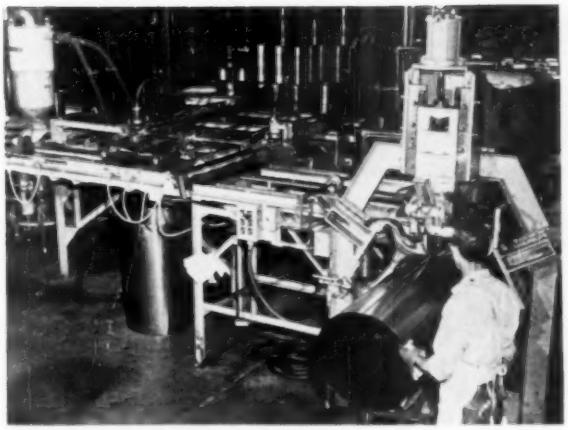
The longitudinal seam weld is made at a rate of 40 ft per minute, and each welded drum is taken by an operator as it leaves the electrodes.

Corrugated and Flanged

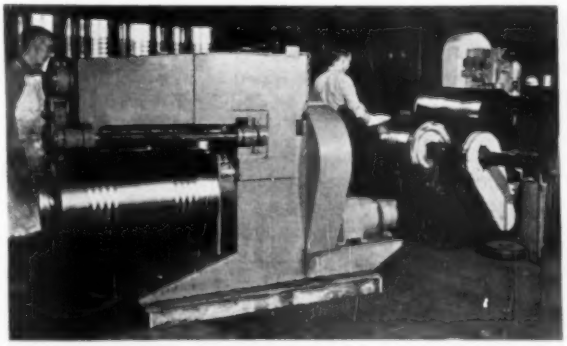
Next step in drum fabrication is the corrugations which are quickly made in two areas on the drum's circumference. Upon completion of this operation, the drums are rolled to a flanging machine which simultaneously prepares both open ends for the fitting of drumheads.

Rolling down a ramp from the flanger, drums are placed in a double-end seaming machine. Both drumheads (one with a flanged, offset opening in it to receive chemicals) are then clamped to the drum. Rollers crimp the seams shut as the drum is revolved.

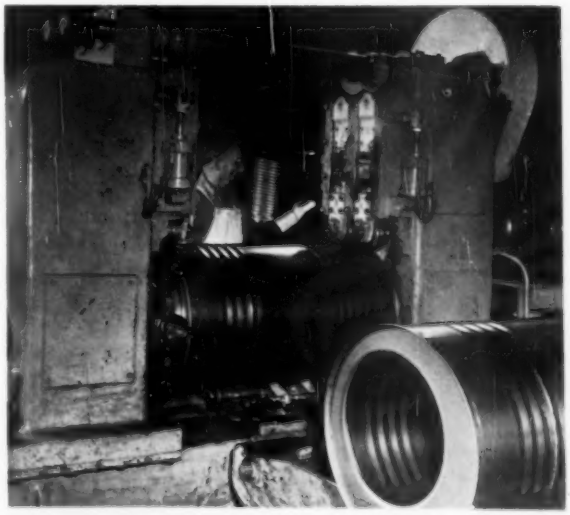
Completed drums are suspended from hooks and taken through an automatic spray-painting operation that gives them a corrosion-resistant coat so necessary for the job they must perform. These drums are used for the shipment of such chemicals as caustic soda, ferrous chloride, calcium chloride in flake and pellet form, and chemical preservative.



SEQUENCE started with placement of steel sheet on table at center-rear of photo ends as seam welded cylinder is removed from 200-kva welder. Sheet was pulled past vacuum grit-blaster at left and two edges were cleaned for welding.



CYLINDER corrugation *(left)* is next step in drum fabrication, then both ends of cylinder are flanged *(right)* to receive drumheads.



DOUBLE-END seaming machine clamps and crimps drumheads to complete job. Painting is next step for finished drum rolling away from machine at lower right.

This article concludes a two-part series based on a chapter in the *Kaiser Aluminum Electrical Bus Conductors Technical Manual.* Part I appears on page 39 of WELDING ENGINEER's November, 1957, issue.

Application aids for arc welding aluminum bus

IN ITS APPLICATION to aluminum alloy bus material, metal-arc welding with flux-coated electrodes has the advantage of producing a highly-concentrated heat zone. Because of this attribute, the process creates less distortion than does gas welding.

Manual arc weldors, however, cannot switch from mild steel to aluminum and expect to apply similar techniques —the latter demands an experienced touch.

Joint edge preparation for arc welding aluminum is simple, and even though welding is confined to the downhand position, joint strength and welding speed favor the capable arc weldor.

Apparatus and Electrodes

Arc welds can be made with standard d-c motor-generator power sources used for joining other metals. Capacity of the power source and electrode size required are determined by thickness of material to be welded.

Reverse polarity is normally used when arc welding aluminum because it provides a stable arc with most flux-coated electrodes. But straight polarity is also generally satisfactory, and a proper setting for individual applications is usually the result of trial and error.

There are many commercially available flux-coated electrodes for arc welding aluminum bus, but the two most widely used are 99+ aluminum and 4043 aluminum alloy.

The 99+ electrode is recommended for EC and 1100 bus bar. For welding 6061, 6063, 55 EC and 56 EC bus alloys, the 4043 electrode type should be used.

Edge Preparation

Because arc welding readily gives good penetration, edge preparation for this process differs slightly from that done for gas welding.

No edge preparation, other than cleaning, is required on material ¼ in. or less in thickness. Heavier materials should be beveled to produce a 60 to 90-deg included angle, and a root spacing of ⅛ in. or less should be used.

Before welding, surfaces should be cleaned of all oil and grease. When welding flat bus from one side, provide a back-up strip of aluminum (or a grooved metal back-up bar) to confine the root of the weld. The groove in the bar should be a half-oval about ½ in. wide and 1/16 in. deep, and should be placed directly below the weld root.

This back-up strip may be either aluminum or water-cooled copper or steel. Where aluminum is used, it is welded to the bus and then removed by chipping after the joint is completed.

Edge preparation for tubular bus is similar to that for flat bus of corresponding thickness, but an aluminum back-up is not recommended because flux may be trapped in the crevice between tubing and back-up.

Welding Procedure

Preheat is usually unnecessary when arc welding aluminum bus. But, on sections thicker than ⅜ in., a slight preheat to about 250 F makes welding easier, improves penetration and cuts distortion.

The arc is struck with a brushing motion. Touching electrode to workpiece is unsatisfactory because the electrode will probably stick. Once an arc is established, its optimum length should be ⅛ to 3/16 in.

If welding current is too low, irregular welds with overhanging weld metal and a rough appearance will result. Poor penetration and undercutting are the products of a welding speed that's too fast.

The electrode should be held approximately vertical to the molten weld puddle and moved with a slight circular motion. This keeps the puddle molten long enough to allow entrapped flux to rise to the surface.

If it is necessary to make more than one pass, remove slag from metal deposited in the previous pass to avoid

Recommended practices for metal-arc welding with flux-coated electrodes

Metal thickness	Edge preparation	Electrode diameter	Approximate weld current
3/32 in.	Square butt	1/8 in.	55-65 amp
	Fillet		60-70
1/8	Square butt	1/8	80
	Fillet	1/8	90
3/16	Square butt	5/32	125
	Fillet	5/32	
1/4	Square butt	3/16	160
	Fillet	1/4	200
3/8	Single-V groove	1/4	220
	Fillet	3/16	260
1/2	Single-V groove on one side	3/16-1/4	300
3/4	Double-V groove	1/4-5/16	375
1	Double-V groove	5/16	450
2	Double-V groove	5/16-3/8	550

excessive porosity. This job can be done more thoroughly if weld metal is deposited at a slow rate in the first pass, allowing flux residues to surface.

Flux removal is actually necessary in the case of all manual arc welds on aluminum bus. These cleaning procedures, which prevent corrosive action, are identical to those used with gas welds.

Physical Properties

Physical properties of weld and base metal are affected by heat developed in metal-arc welding; but the loss is less pronounced than that encountered in gas welding. Welds made in either hardened or annealed tempers of 1100 or EC alloys with electrodes of similar composition will have tensile strengths and electrical conductivities typical of the annealed alloy.

Welds in heat-treatable alloys 6061 and 6063, using 4043 filler rod, will have electrical conductivity and tensile properties typical of the filler metal in the as-deposited condition.

Metal adjacent to the weld in heat-treatable alloys is not completely annealed during metal-arc welding. The physical properties of metal in this heat-affected zone will have physical properties somewhere between the hardened and the fully annealed alloys.

Tig Welding Bus

The Tig (tungsten inert-gas) welding process is widely used on aluminum bus—at high speeds and in all positions.

An a-c power supply is needed for the process, and its capacity depends on dimensions of bus to be welded. Material thickness and the welding position will control magnitude of welding current.

Currents for welding in the flat position are slightly higher than those for vertical and overhead welding. And, just as with other processes, electrode size increases with metal thickness.

Both argon and helium are used as shielding gases for the tungsten arc. Helium requires a higher gas flow than argon, but the helium shield gives greater penetration and faster welding. This deeper penetration is obtained because arc voltage is higher in a helium atmosphere.

Increased welding speed with helium offsets its higher rate of consumption, but argon is preferred by most operators because cleaning action of the arc is more effective and arc stability is better.

Mixtures of argon and helium are used for some applications to combine desirable features of each gas. The 75% helium and 25% argon mixture is commercially available. Other mixtures—for example, 40% argon, 60% helium—are obtained by combined flow from separate tanks of each gas.

Preheat Desirable

Cleaning welding surfaces to remove oil and grease is as necessary for Tig welding as it is for the metal-arc process. Preheat is desirable on sections greater than ½ in. to reduce welding time. A gas torch is ordinarily used for this procedure.

As with other welding processes, edge preparation and amount of root opening for Tig welding are a function of bus thickness. Bevels are unnecessary for ⅛-in. material, but range to 30 deg for ½-in. plate.

Generally, bars less than ¼ in. thick need not be beveled. For bars ⅛ to ¼ in. thick, some root opening is recommended to insure complete penetration. Normally, this gap should be approximately 25% of metal thickness.

Welds should be supported by a backing bar except where welding is done from both sides. This bar may be aluminum, copper or steel. An aluminum backing bar is widely used in Tig welding.

Effective Range

For tubular sections with wall thicknesses greater than ¼ in., edges should be beveled to form a 30 to 45-deg included angle with a square butt lip of ⅛ to ¼ in.—depending on bus thickness. A tubular backing can be inserted before welding.

All metal thicknesses can be Tig welded, but the most effective range for application of this process is from 1/32 to ⅜ in. On bus greater than ⅜ in. thick, preheat is advisable and welding speeds should be slower. (And because of the slower Tig welding speed on heavy sections, the Mig process is more desirable on these applications.)

Electrode size, current setting and gas coverage should be chosen to suit metal thickness being joined. The arc is initiated by touching the tungsten electrode to the bus material. The electrode is then withdrawn to establish the 3/16-in. arc length that is satisfactory for most welding.

The arc is held at the starting point and the electrode moved in a circular fashion until base metal liquefies and a weld puddle is established. Filler rod is added manually from the side as needed to form the weld bead. The torch is usually inclined approximately 20 deg from the vertical to point in the direction of travel.

If more than one pass is required, the weld should be wire brushed before a second pass. Since no flux is used with this process, finished welds do not require cleaning.

Heat generated by welding affects physical properties of the finished weld in a manner similar to gas welding. A small zone extending ⅛ to ½ in. on either side of the weld bead is at least partially annealed by welding heat.

In such strain-hardened alloys as EC and 1100, tensile strength of the heat-affected zone is reduced to approximately that of annealed parent metal. In heat-treatable alloys, the heat-affected zone is reduced in mechanical strength to some intermediate point between typical properties of the annealed and heat-treated parent metal.

Mig Application

The Mig (metal inert-gas) welding process so popular for bus fabrication combines advantages of the Tig method with increased welding speed. The speeds range from 20 ipm on ¼-in. bus bar to 6 ipm on 1-in. bar.

Manual or automatic Mig may be used for bus welding—the former in any position. Heat is concentrated in a small area, and high current densities can be used for overhead or vertical welding. Manual Mig welding techniques differ somewhat from those used with other methods, but a weldor can effectively use this process with only a few days of concentrated training.

Filler rod for Mig welding is supplied as a coil of bare wire. This wire is added to the weld at a pre-set

rate by a motor-driven feed mechanism that is adjustable to suit variations in welding current.

Power source for Mig welding may be any suitable d-c generator, but a constant-potential generator is preferred to produce high-quality welds. This latter type compensates for changes in arc length due to the human element, given more uniform welds. Reverse-polarity current is always used.

The Mig process is generally employed when welding thicknesses greater than ⅛ in., but special equipment will adapt it for applications on thinner bus material.

Preparation for Welding

Oil and grease can be removed from metals to be Mig welded by any degreasing compound available for use with other welding methods. It is also essential that the welding surface be free of moisture. A clean air blast is an effective post-cleaning drying agent.

A widely recommended practice that isn't always employed is that of wire brushing edges prior to Mig welding. The brush will remove surface oxides and insure sound welds.

Available for Mig welding aluminum bus bar are EC, 1100, 4043, 5154 and 5356 welding wire. This filler material can be obtained in 3/64, 1/16, 3/32 and ⅛-in. diameters.

Joint design for Mig is similar to that for Tig welding. Bus bar 3/16 to ⅜ in. thick can be welded satisfactorily, and with complete penetration, using a square butt design. Bus over ⅜ in. thick should have a single-V or double-V groove. Edges of tubular sections are prepared in the same way as edges of flat bus of corresponding thickness.

Aluminum back-up bars of the same composition as parent metals are often used with the Mig process, and they are usually left intact after welding is completed. On flat or tubular bus which is to be exposed to the atmosphere, provision should be made to prevent moisture from collecting in the crevice between back-up plate and parent bus. Moisture in this crevice presents a corrosion hazard which can be eliminated by welding around the back-up bar to seal the crevice.

Inert-Gas Coverage

Either helium, argon, or a mixture of the two are suitable for Mig welding. Pure argon is most widely used on materials less than ¾ in. thick. Thicknesses over ¾ in. are commonly welded with a helium/argon mixture which may range from 60% helium/40% argon to 80% helium/20% argon.

At any given arc voltage, the helium-shielded arc is hotter than an argon arc, but a smoother and more stable arc is obtained with argon. On heavy bus bar, the gases are usually mixed to combine helium's hotter arc characteristics with the stabilizing effects of argon.

Available Mig welding equipment is designed to initiate gas coverage and automatically feed the aluminum electrode into a weld area when the arc is struck. A welding pool is formed immediately the arc is established and the welding gun is moved along the joint at a rate designed to build up a bead of desired dimensions. In flat-position welding, the gun is pointed in the direction of travel and tilted 20 to 30 deg from the vertical.

Bus bar up to ¼ in. thick can be welded in one pass; material over ¼ in. thick may require two or more passes. Where more than one pass is needed, the weld should be wire brushed between passes. Postweld cleaning is unnecessary for Mig welds, and weld beads are not usually finished off.

Physical properties of Mig welds are similar to those made by the Tig process, but are superior to those made by any other process. The concentrated heat of a Mig

Recommended practices for Tig welding aluminum

Metal thickness	Welding position	Edge preparation	Current (amp, a-c)	Electrode diameter	Argon flow	Filler rod diameter	Preheat (F)
1/8 in.	Flat	Square butt 0 to 1/8 in. root gap	125	1/8 in.	20 cfh	1/8 in.	None
	Vertical	Square butt 0 to 1/8 in. root gap	115	3/32	20	1/8	"
	Overhead	Square butt 0 to 1/8 in. root gap	115	3/32	25	1/8	"
1/4 in.	Flat	60-deg single bevel	225	3/16	30	3/16	"
	Vertical	" " "	200	5/32	30	3/16	"
	Overhead	" " "	210	3/16	35	3/16	"
3/8 in.	Flat	" " "	325	1/4	35	1/4	Up to 400
	Vertical	" " "	250	3/16	35	1/4	"
	Overhead	" " "	275	3/16	40	1/4	"
1/2 in.	Flat	" " "	375	1/4	35	1/4	Up to 600
	Vertical	" " "	250	3/16	35	1/4	"
	Overhead	" " "	275	1/4	40	1/4	"
1 in.	Flat	" " "	500-600	5/16-3/8	35-45	1/4-3/8	Up to 600

Typical properties of Tig and Mig welds in aluminum bus conductor

Bus alloy and temper	Filler alloy	Typical properties of parent metal: Ultimate tensile strength (psi)	Typical properties of parent metal: Yield tensile strength (psi)*	Typical properties across welds: Ultimate tensile stress (psi))	Typical properties across welds: Conductivity** % of parent metal
EC-H11	EC or 1100	9,000	4,000		
-H12		12,000	8,000	12,000	100
-H13		14,000	12,000	12,000	100
1100-0	1100	13,000	5,000	13,500	100
-H14		24,000	22,000	13,500	100
55 EC-T6	4043	29,000	25,000	20,000	100
6063-O	4043	13,000	7,000		
-T6		32,000	25,000	20,000	100
6061-0	4043	22,000	12,000		
-T6		42,000	35,000	27,000	100

*Stress to produce 0.2% permanent set.
**Tensile properties and conductivity were taken on a weld with a convex bead. This bead type results in a weld with cross-sectional area slightly greater than that of parent plate. If weld bead were flush, or machined to same cross-section as parent plate, conductivity and strength would be slightly lower.

arc does not raise temperature of adjacent metal as much as do other processes. The heat-affected zone is therefore narrow, and physical properties of the adjacent metal are higher.

Welds produced by Mig are usually sound, so properties of the weld metal itself are superior to weld metal properties produced by gas or metal-arc processes.

Other Processes

Carbon-arc welding is used only in limited applications where suitable equipment is on hand. A flux-coated rod supplies filler metal to the weld, and metal in thicknesses of 1/16 to approximately 3/8 in. can be manually welded. Carbon-arc welding can also be adapted to automatic use if welding volume justifies initial capital outlay.

Atomic-hydrogen welding is adaptable to both manual and automatic applications on metal 1/16 in. thick and more. A flux-coated filler rod similar to that used for gas welding is fed into the arc during welding.

Resistance welding is seldom used for joining bus bar and can only be economically adapted for fabricating small sections suitable for high production. For such applications, flash-butt welding is the most commonly used process, but initial cost of this particular equipment is high and can only be justified in quantity production.

Pressure welding of aluminum and aluminum alloys is new and limited. The joint is made by application of high pressure to surfaces, either with or without heat—and with the complete absence of melting.

Special applications may require copper-to-aluminum welds. This is often necessary when introducing aluminum bus in an existing copper installation, or when taking copper tap-offs from an aluminum bus.

Special processes are required to weld aluminum to copper. When aluminum is welded directly to copper, a brittle inter-metallic compound ($CuAl_2$) is formed. This material makes the weld unsuitable for most bus applications.

To avoid such formation, copper must be coated with a material metallurgically compatible with both copper and aluminum. The silver solders have proved satisfactory for this purpose, and either the Tig or Mig welding processes can be used.

Copper is first cleaned, then coated with an all-purpose brazing flux paste. Heat is applied with a gas torch or other suitable heat source until flux liquifies. A layer of silver solder at least 1/32 in. thick is then laid on all surfaces which will contact the molten aluminum. This solder should have a composition of 50% silver, 15.5% copper, 16.5% zinc and 18% cadmium.

Welded With 4043

After copper is silver-coated, it is cooled to room temperature and cleaned to remove all traces of flux before welding to the aluminum bus bar.

The copper and aluminum parts are positioned and welded with 4043 filler rod. The arc is directed on the aluminum and a molten pool is established. This weld pool is then brought into contact with the silver to avoid complete removal of the silver solder.

It is advisable to keep temperature of the copper below 500 F to prevent silver solder loss. This may be done by interpass cooling.

Operating data accumulated on copper-aluminum welds in service for approximately 2½ years show that joint efficiencies are excellent, and that these welds can meet all normal service conditions required for aluminum bus. A properly designed joint in EC or 1100 alloy will have a tensile strength equivalent to annealed parent aluminum.

A close look at some construction and operation characteristics which help . . .

Silicon rectifiers improve features of d-c welders

By E. F. Steinert
Arc Welding Dept.
Westinghouse Electric Corp.
Buffalo, N. Y.

A MAJOR ADVANCE in the art of rectification has resulted in the application of silicon rectifiers to a wide variety of industrial uses.

Among the most significant is the development of a commercial d-c arc welder.

The silicon power rectifier employed in this new welder represents another step forward in a long series of rectifier developments that include the first use of copper oxide, selenium and germanium. Characteristics of this rectifier are so unusual and desirable that their application to d-c welders had been anticipated by the welding industry long before they actually became available.

3 Features Wanted

For years, the industry sought a d-c arc welder whose performance matched that of a-c equipment. Desirable features included the simplicity characteristic of static components, high efficiency, and durability under extreme operating conditions.

This goal was partially attained with the introduction of a selenium rectifier welder in 1949. Now that silicon rectifiers are available, d-c arc welders match—and sometimes exceed—the best features of a-c welders.

At first sight, the silicon rectifier cell is of interest because of the contrast of its extremely small size with its high current capacity. The active part of the cell is enclosed in a copper capsule with ceramic bushing; the whole enclosure is hermetically sealed.

Cell size and its construction permit the design of a small, compact bridge assembly with six cells (normally) for three-phase, full-wave rectification. Copper plates comprising the bridge assembly provide a mounting for cells, and serve also as radiators for dissipating the small amount of heat developed by the cells.

Unidirectional Flow

Both rectifier cells and the mounting are rugged and practically invulnerable to moisture or corrosive conditions. These characteristics are of particular importance in welders because of the rough usage and adverse conditions normally encountered by welding equipment.

A rectifier cell is the electrical equivalent of a check valve used in hydraulic systems—it permits current to flow in one direction only. But as in the case of a leaky valve, a rectifier cell may allow an appreciable current to flow in the wrong direction. This condition is known as back-leakage and represents a power loss.

As a distinct advantage, silicon cells provide *an almost perfect check* to reverse flow, and back-leakage loss is practically negligible. Reduction in leakage not only reduces welder power consumption during idling, but helps improve welding characteristics.

One function of the reactor in a d-c arc welder is to store electrical energy essential for maintaining a stable arc. When conditions in the arc tend to cause a momentary current interruption—an arc *outage*—stored energy of the reactor is instantaneously released.

If this transient surge of energy is partially dissipated by back-leakage through a rectifier, its effectiveness in sustaining the arc and preventing current interruption is lessened substantially. Having practically negligible leakage, silicon rectifiers provide more efficient utilization of reactor energy, improved dynamic characteristics of the welder, and a more stable arc even under adverse welding conditions.

Cut Current Loss

Silicon rectifiers have very high efficiency. There are two reasons for this:

(*1*) voltage rating of silicon cells is approximately 10 times that of selenium; (*2*) the forward drop of a silicon cell is extremely low.

Forward drop is equivalent to a voltage drop produced by current flow through a resistance in the forward direction. The combined effect of fewer cells in series and lower forward drop reduces rectifier loss in a welder under load to a practically negligible value.

When we add to this a further reduction in idling loss because of insignificant back-leakage, the total reduction amounts to approximately 50% in power loss. This represents a substantial savings on such heavy-current apparatus as welders.

High-Temperature Ability

Silicon possesses yet another unique feature—its ability to operate at temperatures up to 375 F without harmful effect. Although normally operated at temperatures well below this maximum, its high-temperature characteristic provides a wide safety margin.

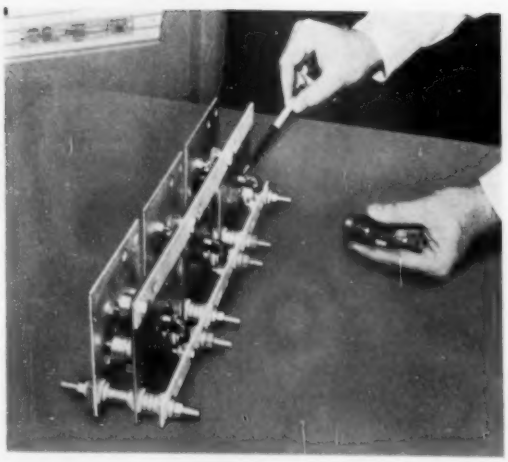
Design of both silicon cell and bridge provides rapid and adequate heat conduction from the active part of the cell into the radiating copper plates. This heat flow, coupled with the wide range in permissible operating temperatures, provides ample capacity to withstand current surges and overloads—in addition to the abnormally high ambient temperatures regularly encountered on arc welding service.

Rectifier-type arc welders proved a radical departure from the firmly established conventional motor-generator type. But their almost universal acceptance during the relatively brief period since their introduction in 1949 is evidence of sound principle and good value to the welding industry.

During these years, constant improvements have been made through new designs to give better operating characteristics and welding performance. With the application of silicon rectifiers, a new milestone in development has been reached.

ON production line, worker assembles silicon rectifier unit on a 400-amp d-c arc welder. Author cites simplicity, high efficiency and operational durability as among best features of silicon rectifiers, and also explains ability of cells to prevent back-leakage of current.

SIX small silicon cells comprise three-phase full-wave rectifier bridge. Each copper-encased, hermetically-sealed cell is mounted on copper plate for support and heat radiation.



SILICON rectifier bridge (*right*) and equivalent selenium rectifier bridge for 400-amp welder. Heat radiating surface of former is only 5% that of latter.

Silicon rectifier cells:

What are they?

How are they made?

By A. M. Christian
Westinghouse Electric Corp.
Youngwood, Pa.

SILICON, THE NEWEST semiconductor rectifier material to be produced in volume, has actually been known for more than a hundred years.

Manufacturing a rectifier cell from the element is a long process. It starts with production of a fairly pure metal from sand, which is then purified further until it has less than one part of impurity in ten million parts of silicon. Silicon is also prepared as a single crystal—that is, with no crystal boundaries in a single mass.

These latter steps are extremely technical and costly, and are complicated by silicon's high melting point (1,420 C), the necessity of working under very high vacuum, and the fact that liquid silicon is virtually a universal solvent.

The resulting small cylinder of hyperpure silicon is sliced, diced into wafers, polished and fused into a rectifying "sandwich" or junction. The sandwich is hermetically sealed into a container designed for easy mounting and to withstand severe ambient conditions. The container and junction is called a "cell".

Silicon rectifier cells are normally furnished in assemblies of complete rectifier circuits. These assemblies consist of a rigid cadmium- or nickel-plated framework with insulated mounting brackets and one or more plated copper plates.

Each plate has a cell firmly affixed to it. A plate is used for both heat sink and for electrical connection, so it is insulated from the frame for special applications and other sizes and plate materials can be furnished.

The assemblies range from single-phase half-ways to polyphase circuits, and have ratings to 900 or to thousands of volts. Ratings include high safety factors in current, voltage and temperature.

Thanks to Tig...

There's GOLD in them thar welds!

GOLD plate, 0.100-in. thick, is butted and Tig welded to form continuous roll that is then brought to finish gage as thin as 0.015 in.

MANUAL Tig torch is held firmly in jig while weldor joins tail-end assembly to copper sleeve. Unit is headed for nuclear service.

ALUMINUM strip is butt welded by Tig method before being clad with other metals. Small tractor at left provides mobility for Tig torch moving across clamped strip.

NOT ALL THE TEA is in China. Nor is all the gold in Fort Knox.

Some of that gold—in the form of rolled plate and fillings for jewelry—is being Tig (tungsten inert-gas) welded by Metals & Controls Corp., Attleboro, Mass.

General Plate Div. of M & C is now in its 42nd year of producing such materials for the jewelry industry in the Attleboro area. But it isn't only *gew-gaws* to which the division applies versatile Tig welding; also fabricated are watch cases, optical frames, pens, pencils and related arts.

Other Products

General Plate also turns out nickel- and aluminum-clad steel for radio tube parts; stainless-clad copper for heat exchangers and utensils; electrical contacts which have bases clad with precious metals, and thermostat metal sheets and parts for electrical, control and automotive industries.

Included among the varied operations of this division are platinum refiining, and the welded fabrication of platinum and platinum-group metals and alloys.

Using Tig equipment manufactured by Air Reduction Sales, this M & C division gets a welding assist in the precision thin-gage rolling of many precious metals. Gold plate, 0.100 in. thick, is regularly butt welded to prepare it for a continuous roll to an eventual finish gage as thin as 0.015 in. Helium is the shielding gas in this manual welding application.

An automatic Tig installation handles another butt welding job—this time on aluminum coils which are formed into a continuous strip prior to being clad with such metals as copper. The shielding gas for this operation is a mixture of helium and argon.

3-Second Cycle

Another M & C division, Spencer Thermostat, finds automatic Tig welding equally valuable—particular-

ly in an application on its "Klixon Power Plug" thermostats. Stainless steel tubes are joined to nickel and iron rods by the welding set-up.

Thoriated tungsten electrodes and an argon shield are used. A three-second weld cycle seals rod to tube at the point of the plug—and a production rate of 400 units per hour is maintained.

In addition to its line of "Klixon" controls, Spencer also produces snap-acting precision switches, and circuit breakers for aircraft, ordnance, automotive and communications equipment.

Fuel Elements Welded

Newest of M & C's four divisions are Nuclear Products and Versaille Products—both of which were added to the corporation's roster early in 1957. Naturally, the Tig process proves helpful to both—at Versaille, for instance, in its application to controls similar to those produced by Spencer Thermostat.

The Nuclear Products Division was an outgrowth of work begun by M & C in 1952 in the field of nuclear fuel fabrication. The division is now a complete facility for the production of fuel elements for atomic reactors.

These elements are made by standard metal-working processes, then protective jackets are welded around those materials susceptible to oxidation. Wherever fuel elements are to be used in liquids or at elevated temperatures, welded cladding or bare uranium foil serve as protection.

Precision Fixtures

Nuclear product work obviously calls for precision set-ups, so carefully designed fixtures and jigs are constantly used in conjunction with Tig welding.

One such set-up is illustrated with this article. A water-cooled manual torch is mounted in a fixed horizontal position to perform circumferential welds on copper. The copper units have a tail-end assembly that is lip-welded to a can sleeve. Helium is the shield.

To the rigid design specifications held by jigs and fixtures—on this job and on others—is added the invaluable speed-plus-quality characteristics so readily derived from modern Tig welding equipment . . . and so vital to every phase of nuclear production.

Close laboratory control and use of virgin metals assure uniformly high quality in foot after foot of this new, versatile rod for . . .

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Attendance, exhibitors make metal show great success

MORE THAN 64,494 persons were clocked during the national metal show at Chicago in November. Individual registration from 42 nations exceeded 51,000.

Added international flavor was provided by 535 foreign scientists attending the Second World Metallurgical Congress also sponsored by the American Society for Metals.

Prior to the Chicago meeting, 250 of these scientists spent two weeks touring 70 American industrial plants and educational institutions. A group of 20 Iron Curtain representatives attended the open sessions. The third congress will again be held in 1962 at Chicago.

A record 524 metal show exhibitors took advantage of the International Amphitheatre floor plan, occupying more than 407,000 sq ft, 17% more than at previous shows. Floor plans for the 1958 show in Cleveland will be ready for distribution soon.

Although not too many welding manufacturers exhibited, here are pictured several that did.

A high volume of business is known to have been written by show participants, one company indicating that more than 7,000 persons visited its booth.

The next ASM sponsored show will be the Southwest Metal Exposition and Congress at Dallas, May 12 to 16.

Even the Reds came to the 2nd World Metallurgical Congress

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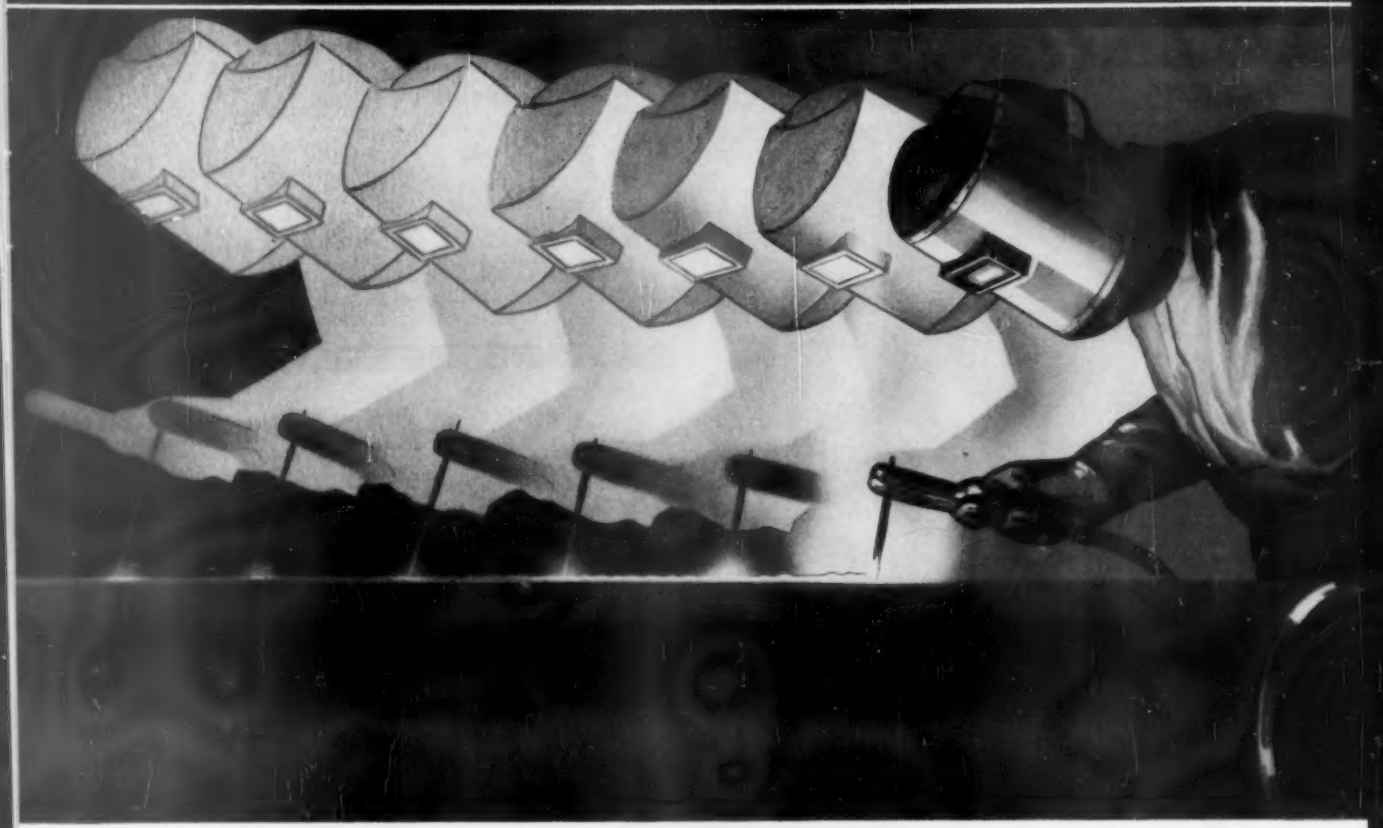

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another NEW product

matches deposit rates of automatic welding..

Manual welding speeds as much as 40% faster than competing electrodes—deposit rates up to 16 lbs. of weld metal an hour—have been obtained in actual tests with TRIPLEX, the new Murex iron powder electrode. Designed for high speed downhand welding with either drag or open arc technique, it produces X-ray quality welds with ultimate strengths of 62,000 to 66,000 psi and elongations of 30 to 33%.

SPEEDEX TRIPLEX offers all the usual advantages of iron powder electrodes. It has good arc characteristics and an easily removed slag. In addition it operates equally well on AC or DC and, in the ¼" diameter, at currents up to 450 amps. It is by far the fastest of the MUREX SPEEDEX line and is especially suited to the welding of large fabrications such as ship sections, freight cars, machine frames and pressure vessels.

Write for specific information on SPEEDEX TRIPLEX. Ask, too, for Folder IP-57 describing the entire SPEEDEX iron powder line.

METAL & THERMIT CORPORATION
Rahway, New Jersey

NEW Semi-Automatic Hard

the ultimate in low cost

Wear O Matic

WIRE FEED UNIT

- Positive feed drive rolls.
- Light-weight one man portability in shop or field.
- Priced right—$279.00 F.O.B. York, Pa. or El Segundo, Calif.

Test this new combination in your own shop. Write stating type of work to be done. An Alloy Rods Company representative will set up a machine for your use.

Alloy Rods

YORK, PENNSYLVANIA

Surfacing Combination . . .

equipment maintenance

Wear O Matic

HARD SURFACING WIRES

- PAYOFFPAK® efficiency and economy
- Tension free wire feeding.
- Quick and simple wire change over.
- Accessability and ease of operation.

Here's a new hard surfacing combination designed to cut maintenance costs through easier, faster, more economical application of wear resistant alloys.

From your first experience with the new Wear-O-Matic process, you'll appreciate the many conveniences of the *PAYOFFPAK*. The wire is cleaner and easier to handle and is free of tension for smoother trouble free wire feeding. Larger quantities of wire can be handled with greater ease of change over. There's no kinking or snarling of wires as is common with cumbersome, tightly wound coils.

Wear-O-Matic wire and the new Wear-O-Matic wire feed unit is the labor saving team that will ease your maintenance load. Welding is easy and continuous at speeds up to five times faster than manual electrodes. The Wear-O-Matic unit feeds the wire automatically at the proper pre-selected rate. There's no stopping to change electrodes, no stub loss, no cleaning, and spatter is negligible. And, Wear-O-Matic wires provide weld deposits of uniform metallurgy, chemistry, and wear resistance . . . assuring longer equipment life.

WEAR-O-MATIC
Hard Surfacing Wires

WEAR-O-MATIC 3—A build up alloy with a machinable deposit. Hardness 20 Rc.

WEAR-O-MATIC 4—A build up alloy which also has exceptional wear resistant qualities. Non-machinable. Hardness 40 Rc.

WEAR-O-MATIC NICKEL MANGANESE—
A build up alloy for manganese steel parts.
Hardness 190 Brinell as welded
500 Brinell work hardened

WEAR-O-MATIC 12—Hard surfacing alloy for heavy impact and moderate abrasion resistance. Hardness 52 Rc.

WEAR-O-MATIC 15—Hard surfacing alloy for severe abrasion and medium impact resistance. Hardness 60 Rc.

WEAR-O-MATIC 40—Hard surfacing alloy for severe abrasion and light impact. Hardness 58 Rc.

GET COMPLETE DETAILS – MAIL THIS COUPON TODAY!

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Company

EL SEGUNDO, CALIF.

Alloy Rods Co.

ALLOY RODS COMPANY **W O 2**
P. O. Box 1828 • York, Penna.
Send me complete information on Wear-O-Matic wires and the Wear-O-Matic wire feed unit.

Name _____

Title _____

Company _____

Street _____

City _____

Zone _____ **State** _____

Welding aluminum to iron can be easy, economical

By Ernest J. Koop

SMALL SHOPS, especially farm machinery repair shops, are wary of welding aluminum to iron.

Three reasons contribute to this wariness toward aluminum welding: claims of "impossible," supposed training problems, lack of customer compensation for extra work. These shops are losing a good source of income.

Replacing the packing gland riser on irrigation shutoff valves or the riser stem on sprinkler connection couplings are examples of aluminum to iron welds.

A land sprinkling system is moved many times in an irrigation season. The inevitable bumping of a riser into other irrigation equipment can crack or break the stem.

Since stems are cast directly into the coupler casting, a break means welding or a drill-and-tap job. The hollow aluminum stem could be welded back, but usually the threads are also damaged. Welding a piece of pipe onto the sprinkler coupling with the upper end threaded is the only economical choice.

Galvanized pipe, with coating intact, should be used if possible. Since zinc and aluminum melting points are separated by only 400 deg, galvanized iron will weld readily to aluminum.

Two welding processes are involved: fusion welding on the aluminum and brazing on the galvanized fitting. When the aluminum melting point is reached, amalgamation takes place instantly.

To obtain a strong, good-looking weld, the major portion of heat should be directed on the aluminum. The galvanized coating will absorb sufficient indirect heat from the flame edge to stay "mushy."

An aluminum arc welding electrode, already coated with sufficient flux to weld most jobs, should be used with an oxyacetylene torch and a slight, fuzzy excess-acetylene flame. A tip large enough to give a soft flame should be used. Rapid progression around the fitting as the two metals flow together will give quick surface cohesion heat, yet avoid deep penetration.

This use of the arc welding electrodes definitely makes it a dual-purpose tool for small job shops.

Aluminum can be welded to black pipe or iron if they are first cleaned and tinned with solder. A zinc-to-zinc bond with aluminum filler metal has proved superior to bronze brazing on spray rig installations because of corrosion to copper and brass by certain insecticides. Copper or brass may also be welded to aluminum in the same manner.

The small amount of materials used in experimenting with aluminum welding is insignificant compared to the knowledge gained. Welding handbooks and magazines offer ready knowledge on these techniques.

"YARD WORK" done the easy way . . .

Important H&M Accessories

THE OUT-OF-ROUND SHAPE CUTTER
FLEXIBLE SHAFT MOTORIZED UNITS
BOXES AND DOLLIES HOOKS, CLAMPS

H&M pipe beveling machines mean speed and accuracy on ANY size of pipe!

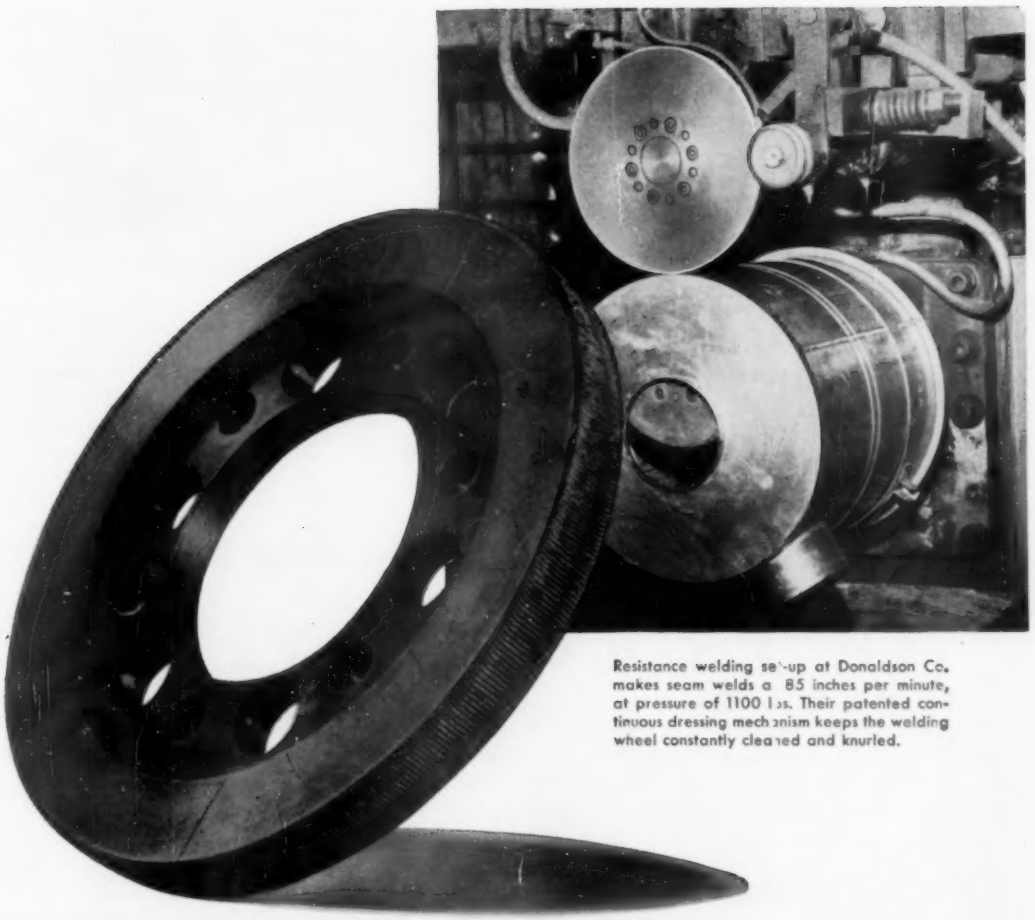
With pipe fabrication becoming increasingly important in the repair and maintenance shops and yards throughout American industry, H&M Pipe Cutting and Beveling Machines offer the easiest, quickest and most efficient solution to preparing pipe for welding, even by untrained operators.

One man can handle and operate any size H&M machine — any of the 7 H&M models handling from 1½" to 36" pipe — after only a few minutes of instruction — and be assured of perfect cuts or bevels every time.

The split-horseshoe gear of H&M machines, plus their extreme lightweight, permits the operator to slip them easily over the next section of pipe and within a matter of minutes the cut or bevel is finished, accurate and true.

H&M TM REG

PIPE BEVELING MACHINE COMPANY
311 E. Third St. Diamond 3-0241
TULSA, OKLAHOMA



Resistance welding set-up at Donaldson Co. makes seam welds at 85 inches per minute, at pressure of 1100 lbs. Their patented continuous dressing mechanism keeps the welding wheel constantly cleaned and knurled.

Half a Million Feet of Seam... Welded by This Mallory Wheel

How long do Mallory seam welding wheels last? Here's an example.

At the Donaldson Company, St. Paul, Minnesota, the Mallory 22 seam welding wheel shown above has just been retired after making about 500,000 feet of 1/8" lap mesh weld on the body sections of big internal combustion engine air cleaners. This service, according to Donaldson, is 3.2 times the life that they used to get with ordinary seam welding wheels.

Several reasons are behind the long life of Mallory wheels. Specialized alloys go into them, developed by Mallory during more than 30 years of leadership in resistance welding. Equally important is the extreme hardness and wearing ability that Mallory adds to these alloys. The result—more welds, better welds, per dollar.

For a cost-cutting consultation on your own resistance welding applications, see your local Mallory Welding Distributor. He carries a complete stock of Mallory electrodes, holders, seam welding wheels and bar stock. And he's well qualified to help you apply these precision-made products profitably.

Expect more... get more from

P. R. MALLORY & CO. Inc.

MALLORY

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In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
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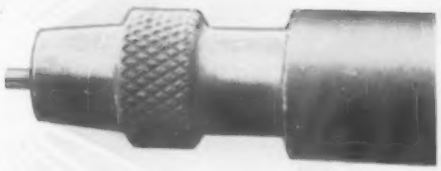
Metallurgical — Contacts • Special Metals • Welding Materials

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio



NEW

WEST·ING·GUN

Cuts Welding Costs! Speeds Production!

GETS EVERYWHERE!

Hard-to-weld Metals Now Welded Automatically! There is now a portable hand gun—for gas-shielded welding of aluminum, mild and stainless steels, bronze, copper and magnesium! Moreover, this hand gun has its *own self-contained wire supply!*

It is named the WEST-ING-GUN. It works with any standard DC welding machine. It has *averaged* horizontal fillets of 22 inches-per-minute—with 1/16" wire! Throughout *extensive* field tests, this WEST-ING-GUN has *doubled men's daily output!*

OPERATOR FATIGUE "ELIMINATED"! This WEST-ING-GUN "handles" as easily as pointing your finger, to weld in *any* position—regardless of cramped quarters! Its portability between gun and control—between control and power-source—provides complete working freedom and ease—up scaffolding—atop ladders—all around any type of workpiece. This gun weighs only four pounds—including its full, pound reel of wire! Operators working a steady 30% duty cycle, with WEST-ING-GUNS, say they "feel no fatigue at all"!

Welding Remote from Power Source!

20-lb control is readily carried up superstructures! Every shipyard visited, during field-tests, immediately ordered WEST-ING-GUNS!

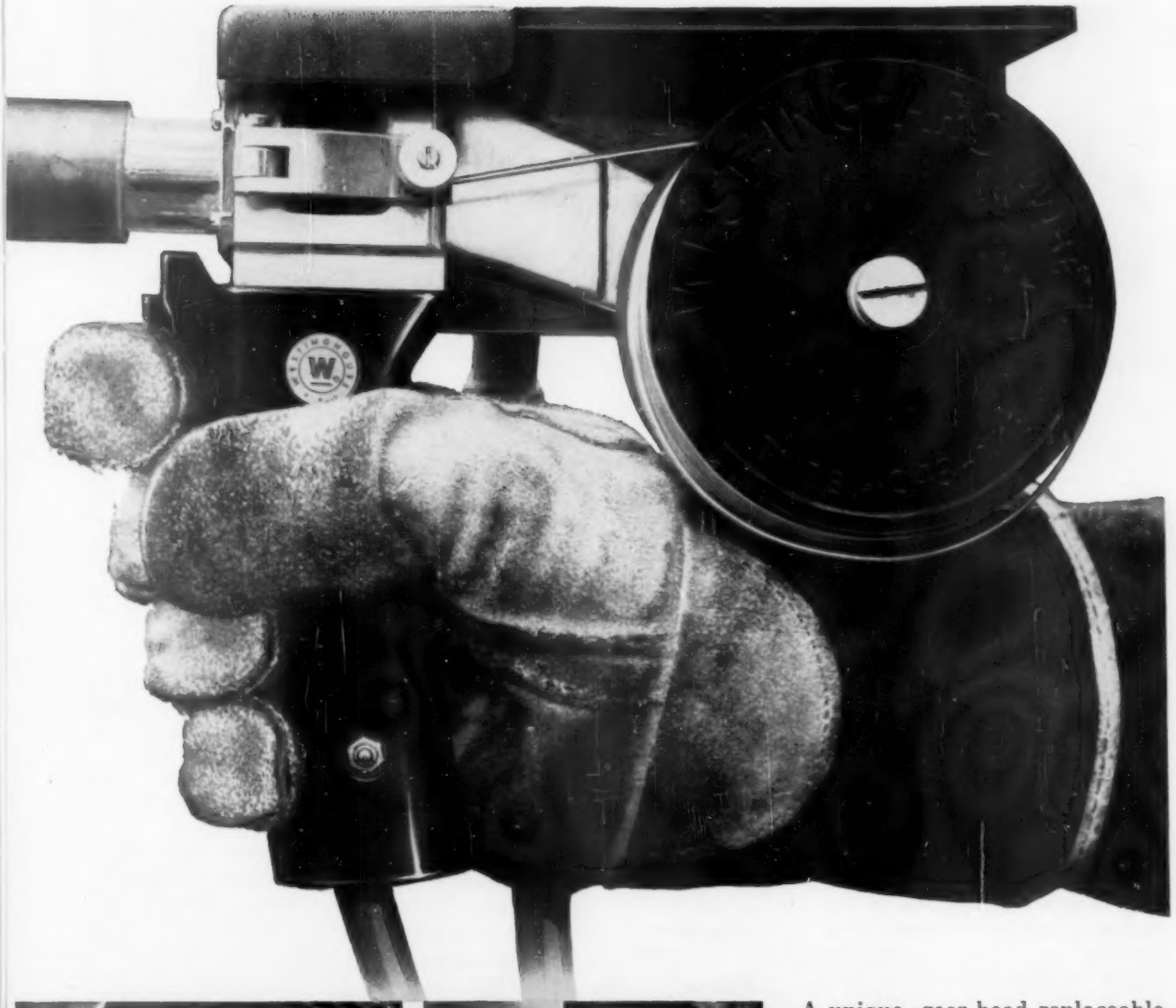
Time Saved in Tight Quarters!

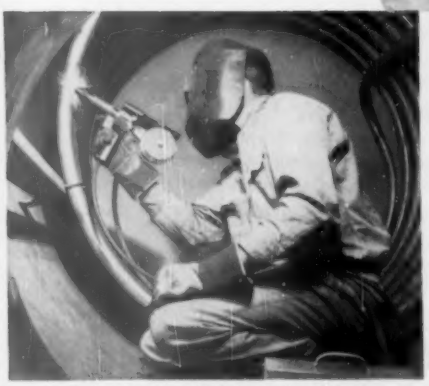
Weld wherever you please! Power and shielding gas are in a single-hose assembly. This permits access to heretofore "impossible" locations!

New Welding Speed on Big Units!

You can take the gun wherever you want to weld! The control stays with the machine! One man can now do the work that used to require two!

Watch Westinghouse for New Developments





Maintenance Welding Simplified!

WEST-ING-GUNS and light-weight control units do the job quickly! Invaluable as a time- and cost-saving production tool!

Aircraft Quality Welds Every Time!

Difficult welds are readily completed with new ease—in production of aircraft equipment—often well back into normally inaccessible areas!

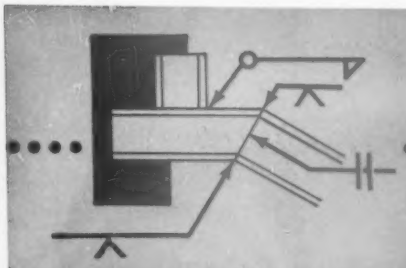
A unique, gear-head replaceable mechanism in the handle drives 1/16" wire up to 350" per minute (finer wire *twice* as fast)! Wire is "inched" at the touch of a button. The short, 6" travel eliminates wire-feeding problems!

There are WEST-ING-GUNS and the controls available—for any DC welders. The compact, rugged control-unit for each model weighs less than 20 pounds. Virtually *every* welding shop has *countless* applications where WEST-ING-GUNS will save *appreciable* amounts of money!

Avail yourself of the opportunity to see what this new production tool can do for you! Contact your nearest franchised Westinghouse Welding Distributor; or write to the Westinghouse Welding Laboratories, Box 2025-A, Buffalo 25, New York.

J-22100

in Welding



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Induction brazing carbide tool tips

Question:

We frequently are asked to weld carbide tool tips to shanks. We have been doing manual brazing, but this method seems to give us a lot of rejects. We wonder if there is not a better, more efficient way of handling this job?

Answer:

There is a way—high-frequency induction brazing. Induction Heating Corp. of New York has been doing a great deal of experimentation along this line and has come up with a technique that will probably apply to your case.

As part of the technique, a silver alloy shim is preplaced between the carbide tip and the steel shank. Shim thickness is determined by the amount of alloy necessary to flow into the shear area of the joint.

Normally, gravity will hold the tip in position. In some cases, however, intricacy of the cutter prevents this. To overcome these situations, the tip and shank can be tied with asbestos string or wire.

Since all surfaces to be brazed should be brought to alloy flow temperature at the same time, a good induction coil must be used.

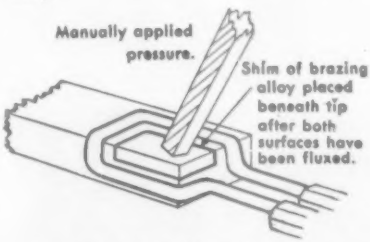
The problem, of course, is that the tip and shank usually heat independently of each other, although they are affected by heat radiation from one piece to the other.

The shank, or cutter, will heat more rapidly to a temperature of approximately 1,300 F since it is almost always made of steel or cast iron. After 1,300 F, its temperature rise will generally fall off appreciably.

On the other hand, carbide will show a lower initial rate of temperature rise—a rate that quickens as heat is continued and increased. Carbide also heats uniformly and so is subject to little internal stress.

The shank will heat at the surface, a fortunate circumstance which conserves energy by concentrating heat on the area to be brazed and reduces distortion from thermal expansion.

As a result, this reduces the likelihood of carbide cracking—a possibility, since steel has twice the thermal coefficient of expansion as carbide. Heat expansion of the steel's surface is counteracted by the restraining force of the cold mass and so the steel strain practically equals that of the carbide. Thus, there is almost no shearing stress on the alloy.



The carbide is placed in the molten alloy by pressing, or even skidding or puddling. This is done to thoroughly "wet" the surfaces for a strong braze. In order to do this, the induction heating coil is usually of the single turn type shown in the illustration.

The coil was designed to create a stronger magnetic field in the carbide than in the shank (which is strongly magnetic). Now, the separate rates of temperature rise will meet at the alloy flow temperature.

By using such a high-frequency heating set-up, you should be able to lower your rejection figures with a consequent rise in production rate.

Question:

Our tungsten electrodes seem to wear out at an alarming rate. Since these are expensive items, we would like to get as much use from them as possible. What can we do to conserve our electrodes?

Answer:

You have touched upon an important topic. Tungsten electrodes longevity can be prolonged—with proper maintenance. Airco, for example, has recommended several methods for husbanding their electrodes.

1 Use the correct magnitude of current for the electrode size.

2 Tig (tungsten inert-gas) electrode holders should be kept free of metal spatter; especially the shielding nozzle. Dirty holders encourage wandering arcs, poor welds and excessive electrode consumption.

3 Keep electrodes clean by leaving them in their original package until they are ready to be used.

4 After the arc is broken, keep the inert-gas flowing until the electrode is below red heat. Above this level, the electrode oxidizes and a blue, black, brown or greenish-yellow coating forms, contrasting to the normal color of polished silver.

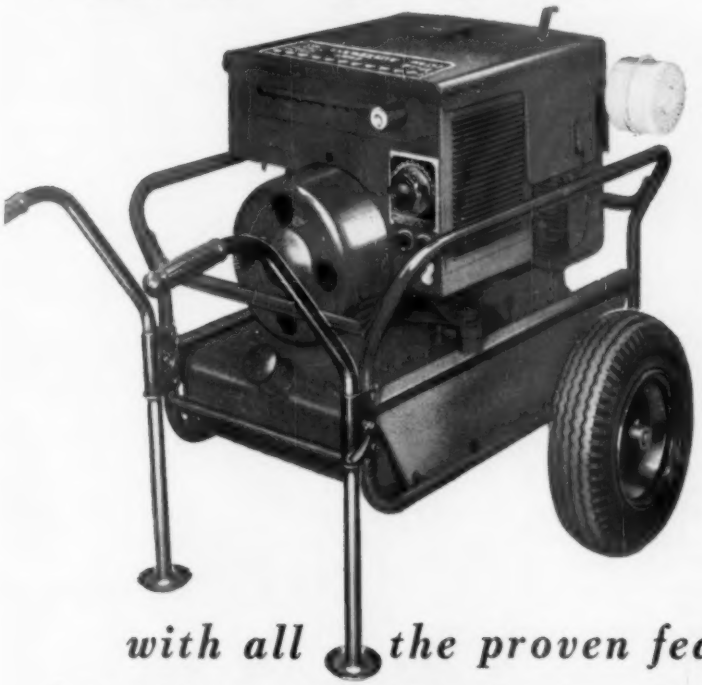
5 Although the electrode should project from the holder nozzle, this projection should be kept to a minimum. This preserves the nozzle and holds down gas flow.

6 Eroded electrodes can be salvaged by breaking off ¼ to ⅜ in. from the welding end. This can be done by nicking the rod with a grinding wheel or hacksaw and breaking with pliers. By so doing you will avoid jagged or bent electrodes.

NEW! . . . from A. O. Smith

THE "BUG"

AIR-COOLED, GAS-DRIVE WELDER



D.C.-200 amps with 115v, 1500 watts a-c auxiliary power

— straight polarity

\+ reverse polarity

with all the proven features you need

Easily portable, heavy-duty welder handles all 1/16″ to 5/32″ and most 3/16″ rods.

Main current tap switch has 12 basic settings from 45 to 200 amps, but operator can set at any rating in between to deliver the exact heat needed for perfect welds on any metal.

Lighter than any 200-amp welder on the market today, this new A. O. Smith machine weighs only 408 lbs. It provides an extremely stable arc . . . responsive control circuits that permit considerable arc length variation without sputtering or dying arc.

Check these advantages

- ✓ **Auxiliary a-c output** — Duplex receptacle on control box permits use of lights or a-c tools. 115 or 230-volt, 1500-watt ratings. Specify for 230 volts.
- ✓ **Smooth-running** — 2-cylinder, 4-cycle engine makes starting and operation easy.
- ✓ **Dual arc reactor** — For more drive on E-6010 electrodes. Optional.
- ✓ **Low-Cost operation** — Average fuel consumption is only ¾ gal. per hr. Idle control adds further economy.
- ✓ **Parallel hookups** — Two or more units can be paralleled to step up power.
- ✓ **Two-wheel dolly** — Optional, allows one man to move welder wherever it's needed.

Through research A.O. Smith *. . . a better way*

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

MILWAUKEE 1, WISCONSIN

A. O. Smith International S.A., Milwaukee 1, Wisconsin, U.S.A.

A. O. SMITH CORPORATION
Welding Products Division, Milwaukee 1, Wis.

Please send me literature on the gas-driven welder.

NAME .....

FIRM .....

ADDRESS .....

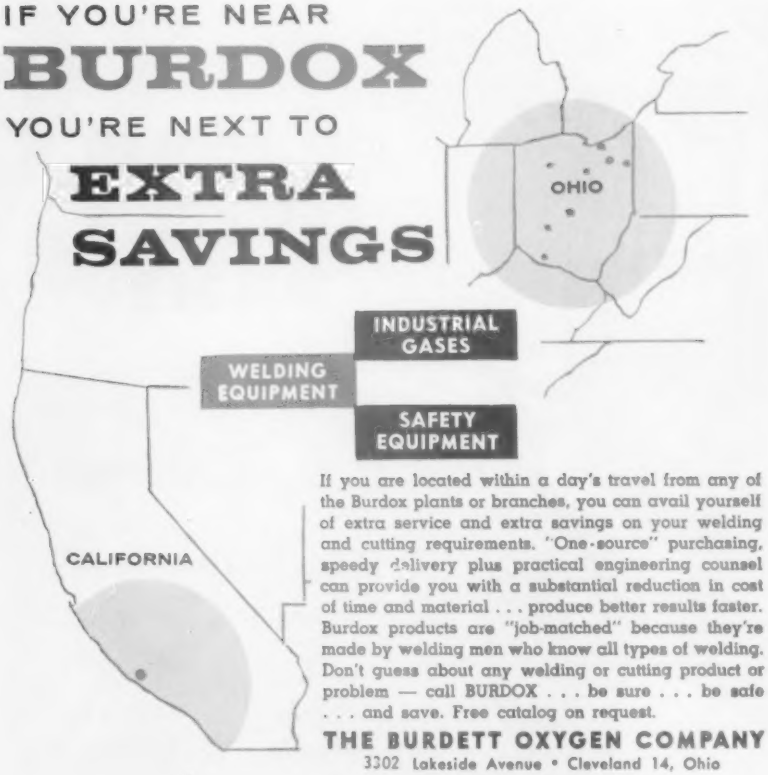
CITY ..... ZONE ..... STATE .....

IF YOU'RE NEAR

BURDOX

YOU'RE NEXT TO

EXTRA SAVINGS



If you are located within a day's travel from any of the Burdox plants or branches, you can avail yourself of extra service and extra savings on your welding and cutting requirements. "One-source" purchasing, speedy delivery plus practical engineering counsel can provide you with a substantial reduction in cost of time and material . . . produce better results faster. Burdox products are "job-matched" because they're made by welding men who know all types of welding. Don't guess about any welding or cutting product or problem — call BURDOX . . . be sure . . . be safe . . . and save. Free catalog on request.

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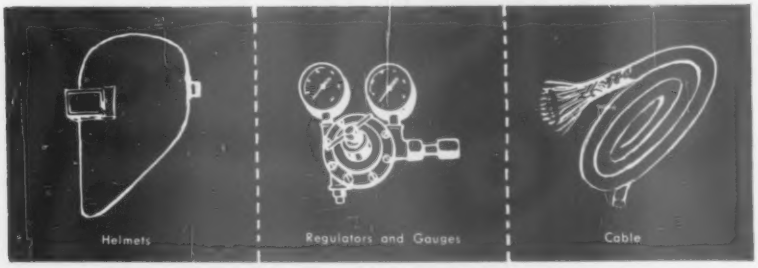


CONVEYOR moves heavy billets to torches for scarfing operation.

Conveyor belts speed scarfing

FLAME-SCARFING surface flaws in working cold finished steel is usually a necessity in the steel industry. Most firms use a gas torch for the job with the operator moving from bar to bar in his work.

One firm, however, Connors Steel, a division of H. K. Porter Co., Inc., has found a method for doing this semiautomatically — conveyor belts move stock from one station to another.

Connors handles 3⅛-4½ in. billets and ranging from 5½ to 11 ft in length. Awkward as these are, they are moved easily by a conveyor belt system which was developed over a period of time by company engineers.

Work begins when a crane stacks billets on a platform. From here a conveyor moves them forward to an inspector, who checks all billets for flaws. After checking one side for imperfections, the inspector turns the bars until all sides have been surveyed. The heavy part of this work, however, will be eliminated when an air-activated turner, now being developed, is put into operation.

Having been inspected, billets are moved, this time laterally, on the conveyor, to scarfers. Actual scarfing is done with natural gas torches. But should a stubborn bar delay the two men on the job, the conveyor belt is so arranged that four or five inspected billets can be stored until handling is possible.

Once the torches have removed any flaws, the conveyor moves the billets to receiving cradles where they are ready to be picked up by crane for delivery to reheating furnaces.

IN THE MANUFACTURING OF IRON POWDER ELECTRODES

Harnischfeger uses Hoeganaes Powders

because of controlled particle size

In their production of iron powder coated welding rods, Harnischfeger Corp., Milwaukee, Wis., uses Hoeganaes W-428 Iron Powder.

There's a good reason, too. In fact, several good quality production reasons why.

One is controlled particle size and the other is chemical analysis. These factors are important in the manufacture of Harnischfeger's well known E-7016 Low Hydrogen Electrodes which are guaranteed as to uniformity within each lot, as well as from lot to lot.

Hoeganaes W-428 Iron Powder is also famous for its "within lot and lot-to-lot" uniformity. It is known throughout the electrodes industry for its exceptionally high chemical purity, its narrow size distribution, and its minimum amount of fines.

Send for your free copy of the data-filled Hoeganaes Folder No. 106. Learn more about what you can expect from iron powder coated electrodes.

Ask your supplier about additional facts. Specify Hoeganaes-coated iron powder electrodes and improve the efficiency of your welding operations.

H S I C

HOEGANAES

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

means

HARRISBURG CYLINDERS

Over a hundred years of the finest skill and experience go into every seamless high pressure gas cylinder produced by Harrisburg Steel since it first started manufacturing them in 1902. Harrisburg offers a complete service organization second to none producing cylinders of both light weight chrome molybdenum steel and standard manganese steel. By constantly striving for improvement Harrisburg has earned its present position in the cylinder business as the top producer, top in quality and top in service life.

More than a Century in Harrisburg 8, Pa.

H HARRISBURG STEEL CO.

Division of HARSCO CORPORATION

TUBES

TRANSPORTS

FLANGES

COUPLINGS

30 YEARS AGO

(Taken from *The Welding Engineer* of January, 1928)

We have just finished the equipment of our third warehouse and branch office at Dayton, Ohio, from which we are prepared to make shipment the same day we receive your order, Central Steel & Wire Co. states in an ad.

—30 YEARS AGO—

The manufacturer who can keep ahead of his competitors by a particularly high standard of quality is in a position to maintain prices at a point which will yield respectable profit, an editorial advises.

—30 YEARS AGO—

The Commercial Gas Co. of Minneapolis is endeavoring to obtain a good oxygen plant operator for a client in Venezuela.

—30 YEARS AGO—

It's hard to judge a man by his clothes, but you **can** judge a welding rod by its nice Blue coat, says a Lincoln ad.

—30 YEARS AGO—

Advertising is expected to increase in the coming year, and advertising in industrial journals will continue to hold its place as the most important avenue to increased sales.

—30 YEARS AGO—

"A discussion of methods for quinquennial testing of purging bottles, dry battery bottles and other cylinders subject to high pressure other than the regular shipping cylinders," was the title of a paper delivered at the GPA midwinter meeting at the Palmer House, Chicago.

—30 YEARS AGO—

An ad headed "A monument of steel" claims contractors and engineers are choosing electric arc welding for joining structural steel members.

—30 YEARS AGO—

"Sand blasting as an aid to the tinning and brazing of cast iron," is an article by C. H. Hollup, vice president of the C. H. Hollup Corp.

—30 YEARS AGO—

A manuscript on the applications of electric arc welding suggests that each locality in the future will have among its industries a "weldery" to produce a great many articles which at present are produced by foundries.

METALLURGISTS • PHYSICAL CHEMISTS • CERAMISTS • SOLID STATE PHYSICISTS

FOR Development of Materials to Withstand Radiation Effects and Thermal Stresses

At the Aircraft Nuclear Propulsion Department of General Electric, development of the direct cycle nuclear propulsion system for aircraft has created problems of a type never faced before: metallurgists and ceramists at ANP must develop structures and components *to resist attrition due to radiative and intense thermal conditions.*

Engineers and specialists: B.S., M.S., Ph.D. – with 5-10 years' experience in metallurgy or ceramics can put their talents to *immediate use* at ANP, striking out along new approaches in:

Metal Processing:
casting, rolling, forging, extruding, swaging, plating, metallizing, brazing
Vacuum Metallurgy:
arc & induction melting, zone refining, brazing, sintering
Welding Refractory Metals
Fabricating Precision Ceramic Parts
Cladding & Bonding Special Metals
High Temperature Diffusion Studies
Materials Investigations & Analyses
Powder Metallurgy
High Temperature Reactor Components
Shielding

PROBLEM ON HIGH TEMPERATURE, NON-POISONING BRAZING RECENTLY SOLVED BY ANP MEN:

Engineers and specialists at ANP—constantly faced with developing new principles and techniques in orthodox disciplines—recently had to create a boron-free brazing alloy for use in reactor core components. Their solution:

DEVELOPMENT OF A NEW BRAZE ALLOY

Melting Point at 2033°F.

Brazing Temperature 2100-2150°

Tensile Strength (at 1200°) 60,000 psi

OPENINGS AT ALL LEVELS

Opportunities are available for those who prefer either analytical operations or direct experimental investigations.

NUCLEAR EXPERIENCE NOT ESSENTIAL

Graduate study, seminars and contact with expert associates help you to develop nuclear competence in your specialty. (A few positions in Components In-Pile Test Scheduling *do* require men with nuclear experience.)

Publication of technical papers is encouraged.

LOCATION

Near attractive suburban communities only minutes away from Cincinnati, Ohio. A progressive city with many cultural facilities, Cincinnati is known as both an engineering center and a fine place to live. (A few positions are open in Idaho Falls, Idaho.)

Please address your resume in full confidence to:

Mr. J. R. Rosselot, Dept. 68-M-M
AIRCRAFT NUCLEAR PROPULSION DEPT.
General Electric Company
P.O. Box 132, Cincinnati 15, Ohio

GENERAL ELECTRIC

TRAY assembly in aluminum-bronze fractionating tower is fabricated by carbon-arc welding, using R Cu A1-A2 filler metal. *(Photo courtesy Ampco Metal, Inc.)*

Author Barnett devotes this 13th article in a series to discussion of copper and copper-alloy . . .

Filler metals for joining

By Orville T. Barnett*

COPPER AND COPPER-ALLOY welding electrodes and rods are as up-to-date as a newly-minted penny.

Copper filler metals join copper-base materials to each other or to such dissimilar metals as steel and cast iron. Other uses include surfacing applications for corrosion resistance, for wear resistance or for bearings.

In recent years, the growing popularity of inert-gas shielded-arc welding processes in joining nonferrous metals has made its mark with the red metals, too. Particularly noteworthy is the emancipation of copper welding from the slow, oppressively hot oxyacetylene process. For many years, this was the only method assuring consistent quality.

*Assistant manager, Metals Research Dept., Armour Research Foundation of Illinois Institute of Technology, Chicago.

(Photo courtesy American Brass Co.)

PHOSPHORIZED copper fractionating tower, 30 ft. long with ¼ to ½-in. shell, was Mig welded with E Cu electrodes.

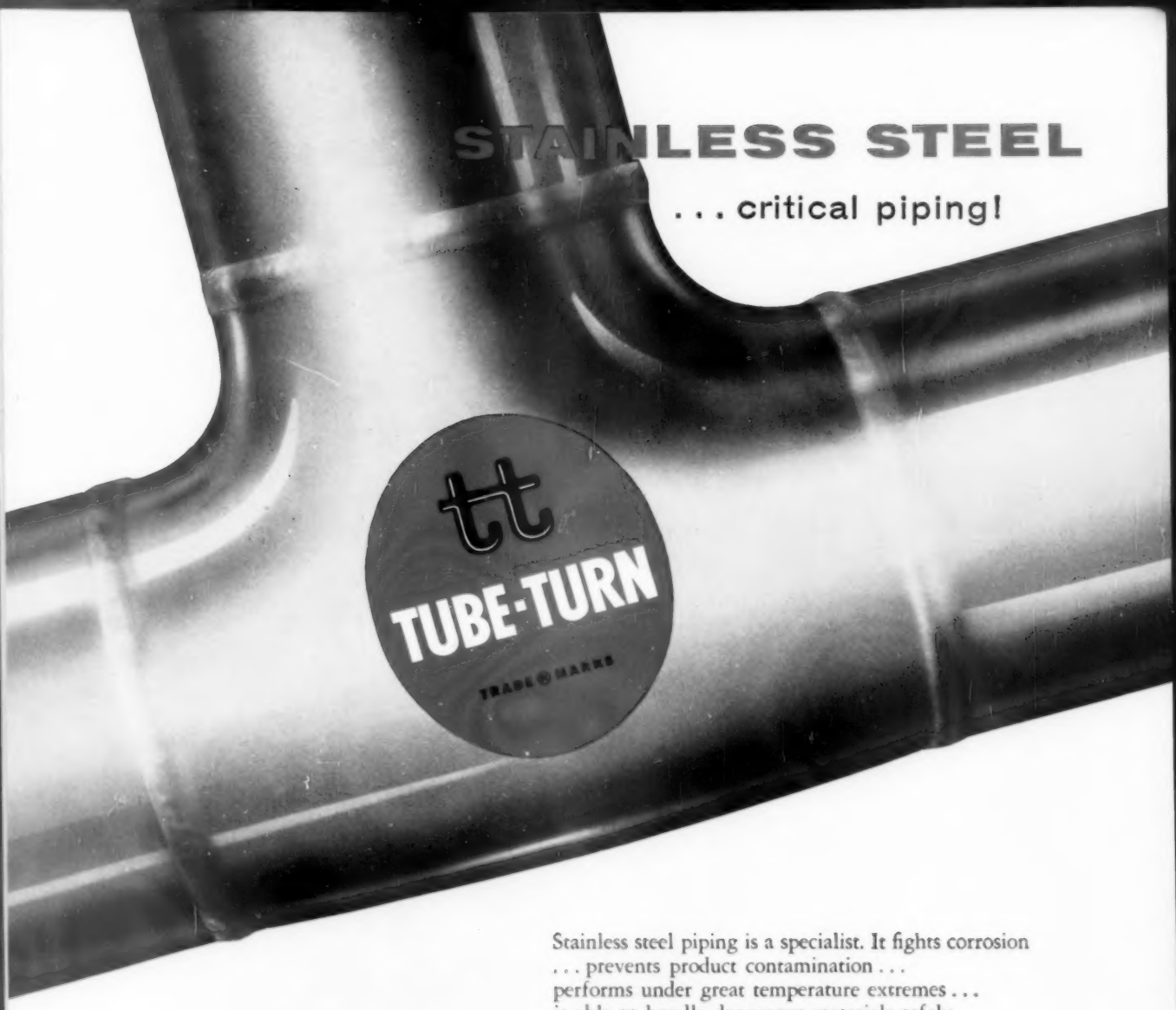
Recent Specifications

Two specifications cover the copper and copper-alloy filler metals intended for welding. The specifications for electrodes (AWS designation A5.6-53T; ASTM designation B225-53T) was issued in 1953. It covers both coated electrodes for manual metal-arc welding and electrode wire in coils for Mig (metal inert-gas) or submerged-arc welding.

Only one year older is the specification for copper and copper-alloy welding rods (AWS designation A5.7-52T; ASTM designation B259-52T). These welding rods are applied by the oxyacetylene, carbon-arc or Tig (tungsten inert-gas) processes.

Nowadays, specifications for welding filler materials follow a sensible pattern that is readily understandable. Prefixes *E*, *R* and *B* denote electrodes for welding, rods for welding and brazing alloys, respectively.

Next, as Table I shows, principal metal constituents are given— *e.g.*, E Cu for copper electrodes, R Cu Zn for brass rods and E Cu Sn for bronze electrodes. Since there are a number of related brass welding rods,



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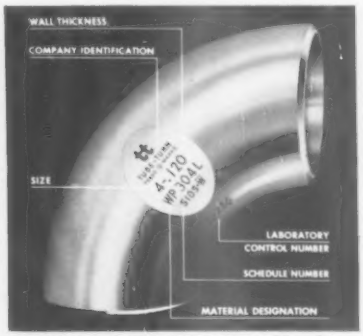

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they bear the family name sorted out by letter suffixes, such as R Cu Zn-A, R Cu Zn-B, R Cu Zn-C and R Cu Zn-D.

In the aluminum-bronzes, some "second cousins" require a letter and number suffix, such as E Cu Al-*A1* and E Cu Al-*A2*.

Perfect harmony, however, does not yet exist among all specifications, since the welding rod, R Cu Zn-A, is identical to the brazing filler metal, B Cu Zn-2. But in view of continuing improvements in filler metal specifications, this anomaly may disappear.

Clear Distinction

Table I presents typical analyses for welding electrodes and rods, and associates classification designations with common names of the filler metals. This mine of filler metal information will be worked to separate the ore of popular usage from the gangue of possible, but currently improbable, procedures.

Using copper as an example, this sorting-out becomes as easily recognizable as the grains of gold glittering amidst the sand in a miner's pan.

(Before discussing copper filler metals themselves, however, here's a helpful word about base metal forms. Three types of copper enjoy widespread commercial use: *1*—deoxidized; *2*—oxygen-free high-conductivity, and *3*—electrolytic tough pitch.

(Numbers 1 and 2 are deoxidized, and both can be welded with joints equalling the strength of base metal

Engineering Data Sheet No. 208

is a part of this article

On the other hand, electrolytic tough pitch copper is welded with E Cu or R Cu filler metals only when a lesser weld strength is tolerable.)

E Cu, R Cu

The coated Cu electrodes used for years are now headed for obsolescence. The Mig process is vastly superior to manual arc welding in this area—offering greater ease of application, higher strengths and more dependable soundness. Mig is the unquestioned leader among copper welding processes.

Cu welding rods are manufactured from deoxidized copper which may contain one or more of these elements: phosphorus, silicon, tin, manganese and silver. Both phosphorus and silicon are employed as deoxidizers.

Those rods containing almost 0.15% phosphorus provide a fluid weld metal that is somewhat self-fluxing, but may yield porous welds ranging down to half the strength of annealed copper base metal. Silicon, tin or manganese, alone or combined in amounts up to those shown in Table I, produce soundest and strongest welds. Welding rods containing up to 1.0% silver exhibit good fluidity.

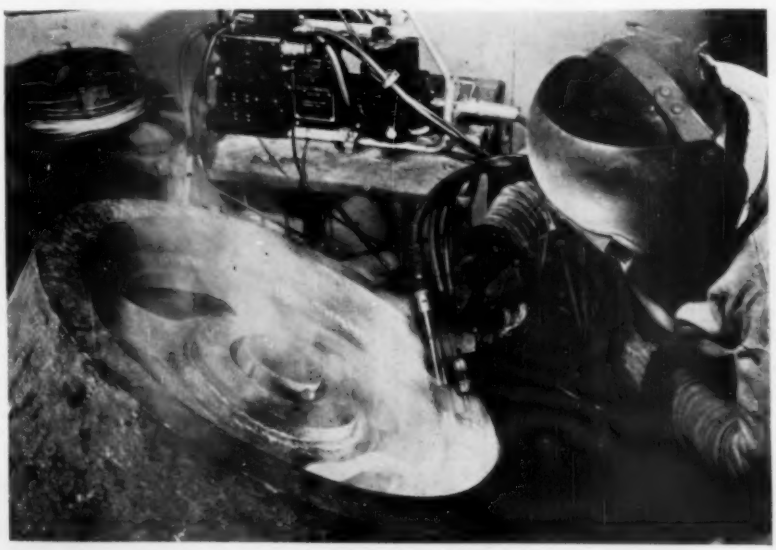
Table II points out that R Cu filler metals can be applied by the carbon-arc, oxyacetylene and Tig processes. The latter, however, stands head and shoulders over the former two processes in any practical comparison. A user's best choice would be a Cu rod and Tig welding for thinner copper, and a Mig-applied Cu electrode for thicker copper.

The usual rule-of-thumb calls for use of Mig wherever either Mig or Tig would be applicable. Mig is faster and therefore less expensive. Preheat temperature requirements for heavy sections bear this difference out nicely: Mig needs 400 to 600 F; Tig requires 400 to 1,000 F.

While most manufacturers distinguish between E Cu and R Cu filler metals, one uses the same material for both. In 1957, issuance of *Filler metal comparison charts* (AWS A5.0-57) by the American Welding Society furnished another essential tool for the user of welding and brazing filler metals. The gap between specification nomenclature and manufacturers' trade names has been neatly bridged.

E Cu Si, R Cu Si-A

Filler metals for electrodes or welding rods may be identical in the above grades. Containing about 3% silicon, plus small amounts of manganese and tin, they are the well-known silicon-bronzes. These filler metals may be used for copper and



GEAR blank for marine service is made of aluminum-bronze and fabricated by Mig welding with Cu Al-A2 electrode wire. *(Photo courtesy Ampco Metal, Inc.)*

(Table I)

Typical analyses of copper and copper-alloy filler metals

AWS-ASTM Classification	Common name	Cu %	Zn %	Sn %	Mn %	Fe %	Si %	Ni %	P %	Al %	Pb %	Others %
E Cu R Cu	Copper	98.0 min. incl. silver	*	1.0	0.5	*	0.50	*	0.15	0.01*	0.02*	0.50
E Cu si R Cu Si-A	Copper-silicon (silicon-bronze)	94.0 min.	1.5(b)	1.5(b)	1.5(b)	0.5	2.8–4.0	*	*	0.01*	0.05*	0.50
R Cu Si-B		97.0 min.	1.5(b)	1.5(b)	1.5(b)	0.5	1.0–2.0	*	*	0.01*	0.05*	0.50
E Cu Sn-A R Cu Sn	Copper-tin (phosphor-bronze)	94.0 min.	*	4.8–5.8	*	*	*	*	0.15–0.35	0.01*	0.02*	0.50
E Cu Sn-C		90.0 min.	*	7.0–9.0	*	*	*	*	0.35	0.01*	0.02*	0.50
E Cu Ni	Copper-nickel	68.0 min.	*	*	1.00	0.40–0.70	0.50	29.0 min.	0.0	(n.s.)	0.02*	0.50
R Cu Ni		67.0 min.	1.0	1.20	1.25	0.60	0.10–0.50	29.0–33.0	0.0	(n.s.)	0.01*	0.50
R Cu Zn-A(c)	Naval brass	57.0 min.	42.0	0.25–1.00	*	*	*	(n.s.)	(n.s.)	0.01*	0.05*	0.50
R Cu Zn-B	Manganese-bronze	56.0 min.	41.0	0.50–1.00	0.01–0.50	0.25–1.00	(n.s.)	0.50	*	0.01*	0.05*	0.50
R Cu Zn-C	Low-fuming bronze	56.0 min.	40.5	0.75–1.00	0.01–0.50	0.25–1.25	0.04–0.25	1.00	(n.s.)	0.01*	0.05*	0.50
R Cu Zn-D	Nickel-bronze	45.0 min.	44.0	(n.s.)	(n.s.)	(n.s.)	0.04–0.25	9.0–11.0	0.25	0.01*	0.05*	0.50
E Cu Al-A1 R Cu Al-A1	Copper-aluminum Aluminum-bronze	92.0	0.02–0.20	(n.s.)	(n.s.)	(n.s.)	0.10	(n.s.)	(n.s.)	6.0–9.0	0.02	0.50
E Cu Al-A2 R Cu Al-A2		88.0	0.02	(n.s.)	(n.s.)	1.5	0.10	(n.s.)	(n.s.)	9.0–11.0	0.02	0.50
E Cu Al-B R Cu Al-B			0.02	(n.s.)	(n.s.)	3.0–4.25	0.10	(n.s.)	(n.s.)	11.0–12.0	0.02	0.50

(a)—Total "other elements," including those marked with asterisk (*), shall not exceed value specified.
(b)—One or more of these elements may be present within limits specified.
(c)—B Cu Zn-2 brazing filler metal meets these requirements and may be used interchangeably with R Cu Zn-A.
(n.s.)—Not specified.

copper-zinc base metal joining, but are most commonly selected for welding copper-silicon base metals.

Mig welding using E Cu Si, or Tig welding employing R Cu Si-A, are once again preferred methods of application. Because these filler metals tend toward hot-shortness, narrow stringer beads and small molten pools yield the most satisfactory results.

Manual arc welding with coated electrodes in all positions is feasible. However, scarcity of such products on the market attests to the limited use of this method. Submerged-arc welding is also a possibility.

Cu Si-A filler rods are applied with a slightly oxidizing oxyacetylene flame and suitable flux. This application is primarily for welding copper-silicon base materials. In carbon-arc welding, this filler material has been chosen for use on deoxidized coppers, copper-silicon alloys, copper-zinc alloys, copper-to-steel welds and the welding of galvanized steel.

With copper-base materials a flux is required. Tig welding is the most popular heat source, however, obviating the need for flux but requiring a somewhat costly gas instead.

R Cu Si-B

Either oxyacetylene or carbon-arc heat sources may be used with this filler metal for welding red brass (85 Cu—15 Zn) piping. These welding rods contain about half the silicon of other silicon-bronzes, with about 1.5% of one or more of the following elements: manganese, tin or zinc. Flux is necessary in this use.

While seven producers make Cu Si-A welding rods, there are but two producers of Cu Si-B rods.

E Cu Sn-A, -C, R Cu Sn

The phosphor-bronze electrodes Cu Sn-A and -B are used as manual coated electrodes or as bare wire for Mig welding. To some extent, they are used to join phosphor-bronzes of similar composition, but find wider applications in welding copper, brasses, bronzes, cast iron and other ferrous and dissimilar metals.

Of the two electrodes, Cu Sn-A is the less common; it is used primarily to fabricate pressure vessels and chemical processing equipment. (Two brands are shown for Cu Sn-A electrodes; there are nine brands for the Cu Sn-C type.)

While Cu Sn-A electrodes may be used to join copper or braze-weld low-alloy steels, such applications are apt to be in the line of repairs or maintenance. Greater tin content of Cu Sn-C electrodes produces weld deposits with higher yield and tensile strengths, along with hardnesses greater than those of E Cu Sn-A deposits.

Cu Sn welding rods are similar to Cu Sn-A electrodes. Nowadays, this type is most commonly applied by Tig welding in the flat position. Phosphor-bronze pressure vessels for the chemical industry represent their most important field of use. While long carbon-arc welding is practical, quality of weld deposits does not match that attained with the Tig method.

E Cu Ni, R Cu Ni

Electrodes of this classification have been applied to 70% copper—30% nickel base metal fabrication in the form of manual coated electrodes for years. Now, the growing popularity of 90 copper—10 nickel with a generally equivalent corrosion resistance at a lower cost is changing the picture.

Although the AWS specification reports that joining of these alloys by Mig welding has not received extensive application, development of E Cu Ni filler types promises to increase inert-arc welding activities in this material.

Cu Ni filler rods are used with the oxyacetylene process and a flux, or by the fluxless Tig process. Both the E and R filler metals are commonly selected to join copper-nickel base metals because of exceptionally good resistance to salt water corrosion.

R Cu Zn-A, -B, -C, -D

In order of popularity, these filler metals should be listed: R Cu Zn-C (14 brands); -A (9 brands); -B (7 brands) and R Cu Zn-D (5 brands). All Cu Zn rods are modifications of 60-40 copper-zinc alloy.

Small additions of tin, iron, nickel, manganese, silicon, etc., change welding properties markedly. Among

Table II—Mechanical requirements of copper and copper-alloy filler metal transverse-tension test specimens

AWS-ASTM Classification	Common name	Tensile strength (min. psi) Copper-alloy base plate	Steel base plate	Applicable process (a)
E Cu	Copper	25,000		I, M
R Cu				C, G, I
E Cu Si	Copper-Silicon	50,000		I, M, S
R Cu Si-A	(silicon-bronze)			C, G, I
R Cu Si-B		35,000		C, G
E Cu Sn-A	Copper-tin	35,000		I, M
R Cu Sn	(phosphor-bronze)			C, I
E Cu Sn-C		40,000		
E Cu Ni	Copper-nickel	50,000		M, S
R Cu Ni				G
R Cu Zn-A	Naval brass	50,000	40,000	G
R Cu Zn-B	Manganese-bronze	55,000	45,000	G
R Cu Zn-C	Low-fuming bronze	57,000	50,000	G
R Cu Zn-D	Nickel-bronze		60,000	G
E Cu Al-Al	Copper-aluminum	55,000		I
R Cu Al-Al	(aluminum-bronze)			C (b), I
E Cu Al-A2		60,000		M
R Cu Al-A2		65,000		C (b), I
E Cu Al-B		65,000		M
R Cu Al-B		70,000		C (b), I

(a)—C: carbon-arc welding
G: oxyacetylene welding
I: Inert-gas arc welding (Mig, Tig or carbon-arc)
M: Manual metal-arc welding with coated electrodes
S: Submerged-arc welding
(b)—Flux is required for carbon-arc welding of aluminum-bronzes

Table III—Hardness of copper and copper-alloy weld metal

AWS-ASTM Classification	Brinell hardness (500-kg load except as noted)
E Cu R Cu	25-40 Rockwell F
E Cu Si R Cu Si-A	80-100
R Cu Si-B	60-85
E Cu Sn-A R Cu Sn	70-85
E Cu Sn-C	85-100
E Cu Ni R Cu Ni	60-80
R Cu Zn-A	70-90
R Cu Zn-B R Cu Zn-C	80-110
R Cu Zn-D	90-110
E Cu Al-A1	100-158[m]
R Cu Al-A	100-130[c] 100-150[t]
E Cu Al-A2	150-170[m] 130-150[s]
R Cu Al-A2	100-130[c] 100-150[t]
E Cu Al-B	140-180[s]
R Cu Al-B	140-180[c] 180-220[t]

Processes (all 3,000-kg load):
m: Mig
c: carbon-arc
t: Tig
s: shielded metal-arc

more noticeable effects are improved mechanical and corrosion-resistant properties and fluidity; more completely deoxidized weld metal, sounder deposits free of slag or blow-holes; pronounced reduction in fuming (Cu Zn-C rods are often termed "low fuming") when overheated, and increased hardness of deposit for better wear resistance.

Cu Zn-A (Naval brass) welding rods contain about 1% tin, added to improve strength and corrosion resistance. This type is used primarily in braze-welding steel, cast iron and malleable iron. The "A" rods also find use in oxyacetylene welding of brass, and braze-welding of copper, bronze and nickel alloys.

Cu Zn-B (manganese bronze) rods include a maximum of 1% each of manganese, tin and iron. These additions bolster strength, hardness and corrosion resistance of the weld metal. "B" rods are used as a surfacing material for building-up bearings, and in many instances for braze-welding steel and cast iron.

Cu Zn-C (low-fuming bronze) welding rods are similar to the "B" type, but have slightly less than 0.25% silicon. This silicon addition subdues fuming or oxidation of zinc to a striking degree. Mechanical properties of the weld deposit are a little better than "A" or "B" types.

Low-fuming qualities, excellent usability and good mechanical properties all combine to make this the most widely-used, general-purpose, copper-zinc welding rod. Like the R Cu Zn group, it is used with the oxyacetylene process only. High zinc content of these rods makes them hard to control with concentrated heat sources of electric arcs.

Braze-Welding Advantages

The Cu Zn filler rods—some of which are flux coated—are widely used in braze-welding iron and steel. This oxyacetylene procedure produces braze-welds in less time than is required for ferrous welds. While preheating is still required in cast iron welding, it need not be as extensive as is the case with ferrous filler metals. Often, only the weld areas need be heated to a bright red.

Five major braze-welding advantages are:

1—Economy in welding time and gas consumption;

2—Expediency of repair-welding in position;

3—Development of low residual stresses with less distortion and less tendency to crack;

4—No embrittlement and complete machinability of weld areas in all types of cast iron;

5—Minimum delay in returning repaired parts to service.

Huge cast iron machinery repairs account for a substantial tonnage of R Cu Zn-C welding. And many tons of these rods are also used in braze-welding cast steel to cast iron, steel tubular parts for furniture, bicycle frames, and many other fabrications.

Aluminum-Bronze Types

Aluminum-bronze filler metals fall into two groups: (*1*) Cu Al-Al, a copper-aluminum alloy, and (*2*) Cu Al-A2 and Cu Al-B, which are both copper-aluminum plus iron alloys. These alloys are used for welding aluminum-bronzes, dissimilar base metals, bearing surfaces, corrosion-resistant surfaces and mild wear surfaces. (Table III lists hardness values for bearing and wear surface guidance.)

Cu Al-A1 electrodes are used only for Mig welding, and are employed primarily in fabricating annealed aluminum-bronze in wrought or cast forms. In addition, this filler metal is selected to provide weld surfaces for bearing or corrosion-resistant services. (Cu Al-A1 welding rods, with the Tig process, parallel electrode applications.)

Cu Al-A2 electrodes are applied by the manual metal-arc or the Mig process. This filler metal has widespread use in joining aluminum-bronzes of similar composition, as well as high-strength copper-zinc alloys, silicon bronzes, some nickel alloys, ferrous metal and alloys and many dissimilar metal compositions. It performs yeoman service in giving bearing, wear- and corrosion-resistant surfaces.

The Cu Al-A2 rods, applied by carbon-arc or the Tig process, duplicate electrode performance.

Two-Phase Structure

Cu Al-B electrodes are useful only as manual coated types. They join wrought aluminum-bronzes of similar composition, or provide three types of surface overlays: bearing, wear- or corrosion-resistant. Here, too, Cu Al-B rods do the same job as the electrodes by teaming-up with carbon-arc or Tig heat sources.

The two-phase structure resulting from Cu Al-B filler metals is less apt to crack in highly-stressed weldments than a single-phase weld deposit. (Because of difficulties in removing tenacious aluminum oxide by fluxing, Cu Al welding rods are seldom used with oxyacetylene welding.)

Copper and copper-alloy filler metals find wide application in original fabrication of nonferrous and ferrous materials alike. For the maintenance and repair of cast iron and cast steel, as well as nonferrous equipment, they return costly equipment to production-line activity in jig-time with dollar savings that are impressive when compared to replacement costs.

In the area of welding dissimilar metals, the copper-alloy filler metals give the designer a great freedom of choice. And their many surfacing applications allow a veneer of copper alloy to operate in partnership with an inexpensive base metal to perform well in severe service environments.

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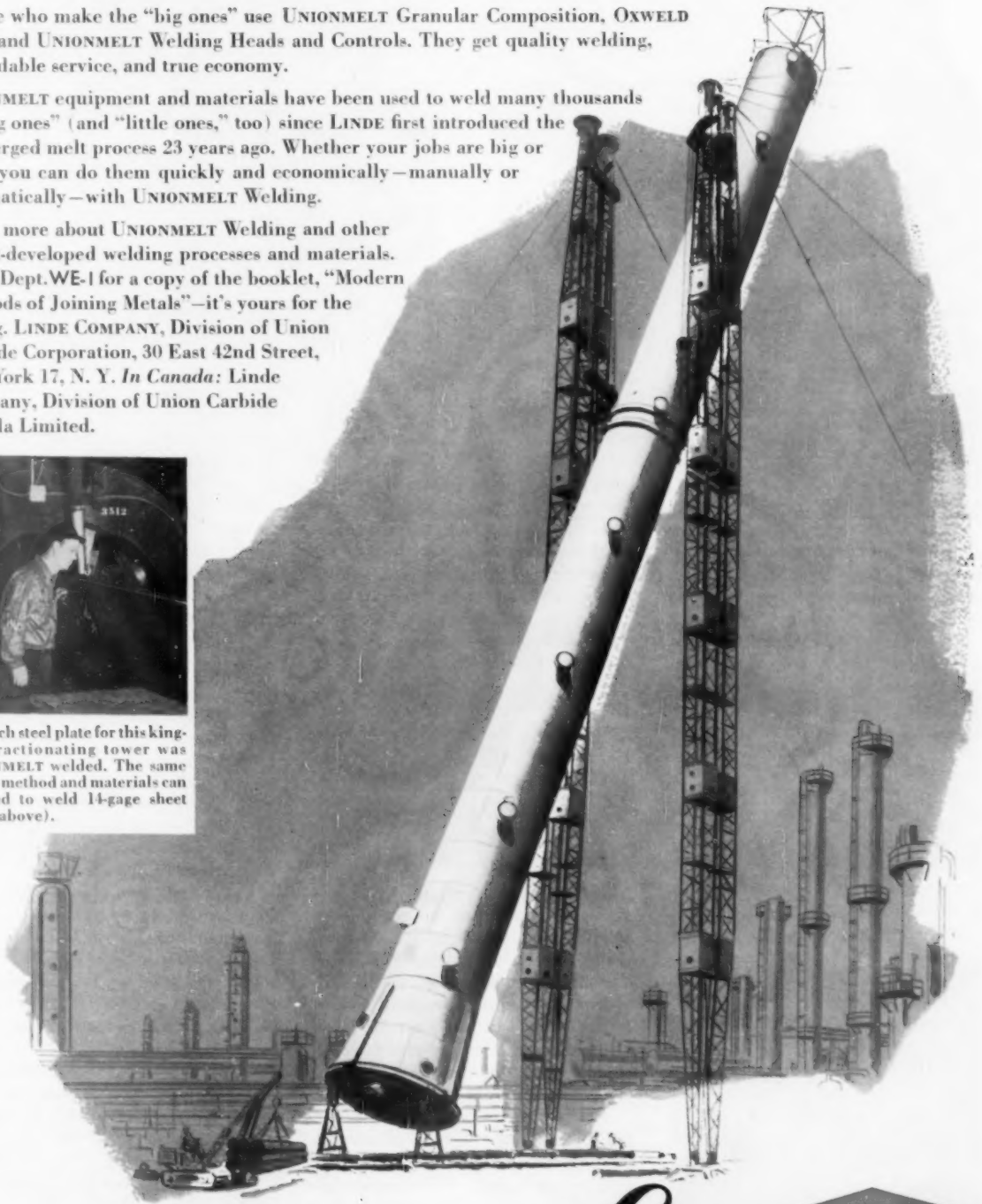
One-inch steel plate for this king-size fractionating tower was UNIONMELT welded. The same LINDE method and materials can be used to weld 14-gage sheet steel (above).



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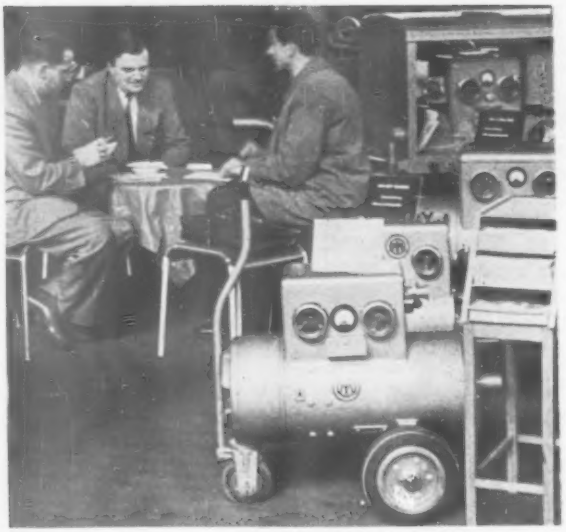


ARC WELDERS by the Dalex and Muller Co. were shown in various models, including a-c and d-c motor generators (stationary and portable). The models were manufactured by Niepenberg & Co., Wissen, Germany.

Western Europe stands out as

The new frontier in the welding industry

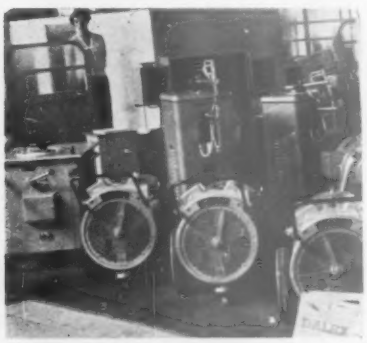
By P. C. Hobart

THE AMERICAN welding industry could very profitably enter Western Europe with an offer of technological advances while utilizing the excellent manufacturing conditions.

The advent of the European common market in the near future with its potential of 160 million people makes serious consideration of this industrial area advisable by anyone who already has done or anticipates doing business in Europe.

(Editor's note: Western Europe is well on the way to doubling its prewar steel capacity by 1960. The impact of this large scale expansion is likely to be felt throughout the world in a few years.)

At the fifth European Machine Tool Exhibition in Hanover in September, the awesome rise of Germany back into the ranks of the world's industrial leaders was one of the first impressions received. At least a third of the exhibitors were German; their percentage continues to increase each year. And where Germany leads, Europe follows.



COMPLETE line of well designed portable m-g sets, spot welders and transformers were displayed at the fair by Mueller & Co., Cologne.

At the Hanover Fair welding was not considered an important production tool and was hardly represented. It was due probably to the lack of design progress rather than lack of importance since many of the machine tools were welded.

Prewar Levels

The welding exhibits showed a European adherence to manual arc welding and lack of interest in automatic procedures. Machine designs, outdated and awkward controlling methods and limited range of models set the exhibits at their prewar level. There are almost no automatic applications except for spot welding, gas cutting and profiling.

The German firms of Dalex and Muller, and the Swiss' Soudronic were the main exhibitors of European welding equipment. Their concentration on spot welding machines makes them the most advanced of any of the equipment, while the transformers and electric drive welders seemed obsolete by American standards.

Through international fairs such as this, which will soon be open to all countries of the free world, we can educate European manufacturers to more modern welding and its greater economies.

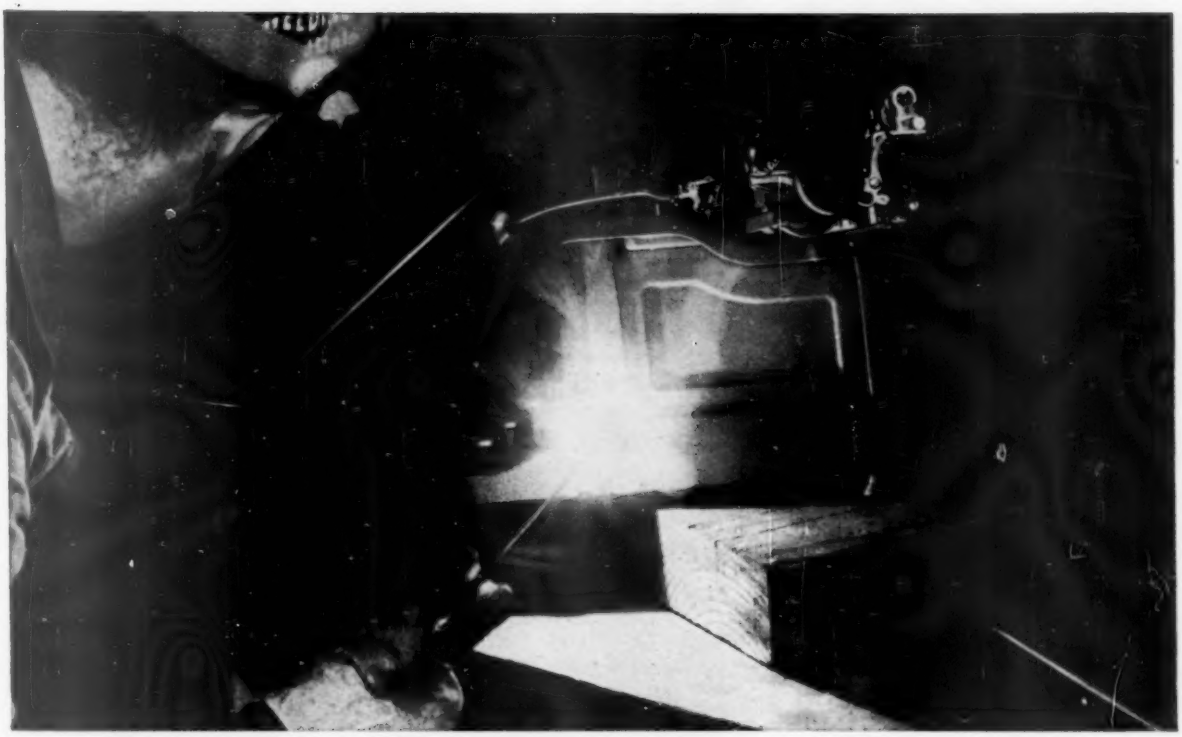
The American reconstruction administration, political make-up of the country and German temperament are contributing factors to Germany's post war rise.

Welding Lags

Many of the prewar American industries, such as General Motors, Esso and Ford, were encouraged to rebuild their plants after the war. With newcomers to the international field, such as General Foods, Deere & Co., and Johnson & Johnson, the total of American investment in West Germany has been raised to its present level of $365 million as compared to $500 million in 1940.

Under the direction of Marshall Plan funds to free enterprise and the economic wonders worked by Conrad Adenauer and his party, German economic stability is the best in Europe and production has almost reached prewar levels. Germany now boasts such standings as the world's second largest car manufacturer, third largest steel producer and fourth largest coal producer. Capital shortage seems to be the only real problem.

Production is reaching incredible heights through 60- and 70-hour work weeks. Lack of trade unions and the influx of manpower from East Germany have kept wage levels down. A change is in the air, but at present they provide welcome impetus to a rising German free economy.



Shop gets 50 to 100 extra welding jobs per month!

Ni-Rod makes broken typewriter frame castings good as new

Not long ago, weldors at the F. G. Welding Works, Inc., of Chicago, tried something new – welding broken cast iron typewriter frames with Ni-Rod* electrode.

Today, they're welding some 50 to 100 frames every month–a healthy portion of extra, profitable business!

Ni-Rod electrode was the ideal choice for welding the cast iron frames because of its quick and easy deposition. The fast metal arc process confines heat to the area being welded, and the weld is completed before heat can spread to a large area and cause stress distortions.

Excellent machinability of the welds is another reason repair with Ni-Rod electrode is so satisfactory. Welds are finished easily. Paint up perfectly. Frames look as good as new . . . and are!

There are a host of other cast iron welding jobs you can do successfully – and profitably – with Ni-Rod electrode. Many of them are discussed in *A Handy Guide to Welding Cast Irons.* This useful illustrated handbook gives tips on preparation, welding techniques, increasing machinability, welding heavy sections and stress relief–to name a few subjects covered. If you'd like a copy of this guide book, just write Inco.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

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INCO WELDING PRODUCTS

Electrodes • Wires • Fluxes

YOUR BEST MOVE . . . MOVE
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3-9-6

CORNER joint on small sign frame is manually Mig welded (*above*). At right, worker points out fine weld beads joining aluminum signpost to base.

Your Lincoln Tunnel guides are Mig welded aluminum

THE SIGNS pointing the way to, through and away from the third Lincoln Tunnel tube are also signs of the times. They're welded aluminum.

C. Frederick Wolfe, Inc., Glendale, L. I., handled fabrication of the signs and guideposts, using the Mig (metal inert-gas) process exclusively, in both manual and automatic applications. Mig equipment used was manufactured by Air Reduction Sales Co.

Dozens of sign shapes and sizes had to be made—ranging from several square feet to giants measuring 20 by 135 ft. All are now helping in the massive task of guiding the thousands of motorists who daily travel beneath the Hudson River between New Jersey and New York.

Approximately 40 tons of Alcoa aluminum—mostly ½-in.-thick material—was welded during the course of the job. Some welds were as long as 20 ft.

Aluminum was a logical choice for this extensive installation. Its lightness simplified erection, and durability of the welded metal will keep maintenance to a minimum.

TRAFFIC flow is improved, thanks to readable porcelain-enamel signs on welded aluminum structure bracketing tunnel exit.

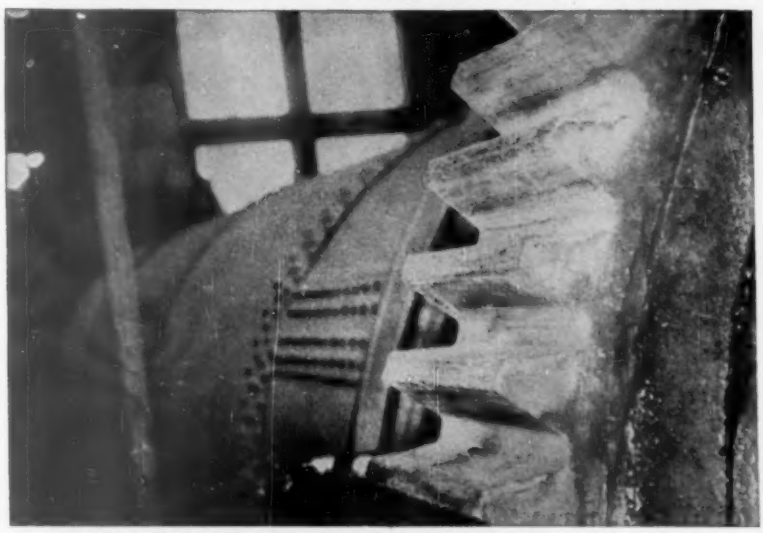
ORIGINAL
Low Temperature
EUTECTIC
WELDING ALLOYS

EUTECTIC Welding News

PUBLISHED BY EUTECTIC WELDING ALLOYS CORPORATION, 40-40 172 STREET, FLUSHING 58, NEW YORK, N. Y.

"EUTECTIC" WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS

"EUTECTIC" CAPS CAST IRON TEETH TO PREVENT COSTLY CAVITIES



(Each tooth required 2½ pounds of alloy for overlaying; each is a foot long. Job was further complicated by sticky coat of grease over the entire gear.)

Hard use of this huge gear meant extreme wear of its foot-long teeth. The result...frequent breakdowns, and finally, complete stoppage.

The gear—part of a large rotating oven in a Northwest aluminum mill—could not be replaced for several months. Concerned over this expensive shutdown, management turned to their local "Eutectic" Technical Representative for a solution.

After inspecting the gear, Eutectic's Technical Representative recommended overlaying the worn teeth with EutecRod 185 FC...a Eutectic "Low Temperature Welding Alloy"® for torch use.

All 115 gear teeth were overlayed, and the gear was put back in operation. After six months of continuous operation, the overlays have proven unusually wear resistant. Breakdowns have ended...the gear functions with complete dependability. Originally thought of as a stop-gap measure, this "Eutectic" overlaying procedure is now standard. The company also has cancelled its order for a new...and very costly... gear.

TECHNICAL DATA

EutecRod 185 FC is a *flux coated* alloy of BronzoChrom. Its extremely hard and tough deposits—high ductility and low friction coefficient—makes it perfect for build-ups and overlays on cast iron. Hardness as deposited is BHN 110, with a work hardness to BHN 200.

EutecRod 185 FC *doesn't* require fusion of the base metal surface. This permits the very lowest base heats. High heat embrittlement, warping and distortion are eliminated...a big advantage when working with cast iron. For complete technical information about EutecRod 185 FC write to Eutectic's Technical Information Department.

2970 Lb. CYLINDER SAVED

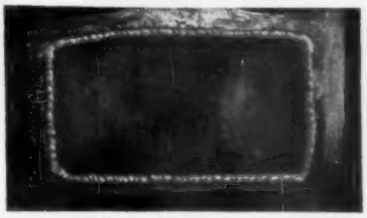
Cylinder Is 7½ Ft. High, 42 In. Diameter

A permanent overload on a 3,000 hp engine caused cracks in cylinder wall. Replacement would cost the owner—an Eastern power plant—$3,100.

After consulting with local "Eutectic" Technical Representative, it was decided to chamfer cracks with Eutec Chamfer-Trode (DC Straight). Its special ecothermic coating concentrates arc and blasts away unwanted metal...no finishing operation is needed.

Welding was done with Xyron 2-25 (AC-DC). This "Frigid Arc" coated alloy produces a high nickle alloy especially balanced to produce dense, smooth, crack-free, machinable deposits without preheat. Ultimate tensile strength is 56,000 psi. After two years in operation, cylinder still operates perfectly—continued excellent service is expected.

TO REPAIR A CRACKED MARINE ENGINE...



...a cast iron plate had to be welded to the outside of the cylinder block. Eutectic's Xyron 2-24 (AC-DC) was used. This alloy's ultimate tensile strength of 50,000 psi permitted the welded plate to withstand pressures of 3 atmospheres.

Xyron 2-24 (AC-DC) has a special core metal with "Frigid Arc" flux coating for application ease. Enables rapid work in difficult, awkward position, since spatter is reduced to a minimum and alloy deposits smoothly and easily.

FREE—JUST OFF THE PRESS—

NEW 1958 180 page pocket welding data book. Complete guide to modern welding techniques.

EUTECTIC'S TECHNICAL INFORMATION DIGEST HELPS YOU MAKE BETTER, FASTER WELDS

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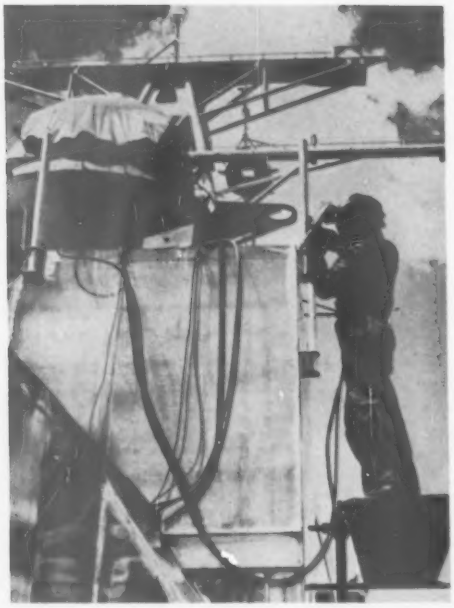
AUTOMOTIVE WELDING ISSUE (TIS 2822)
Latest welding techniques to do better repair jobs on your automotive equipment. Everything from body work to motor blocks.

TOOL & DIE ISSUE (TIS 2831)
Costly tools can be fabricated inexpensively in any shop with welding. Expensive dies, whether cast iron, cast steel or kirksite can be repaired quickly. This manual tells how.

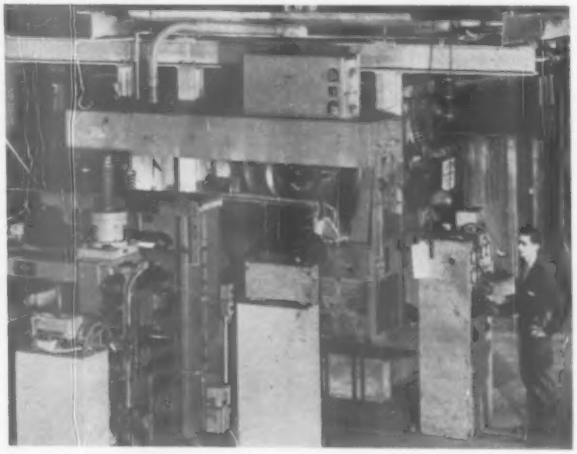
CONSTRUCTION MAINTENANCE WELDING ISSUE (TIS 2832)
Keeping equipment moving is essential to any builder. Learn new techniques that assure longest, most efficient service life from construction machinery and tools.

On the job...

ALLOY steel reinforcing bars welded end-to-end form continuous steel strands in column supports in Borg-Warner's new Chicago office building. Supplied by Joseph T. Ryerson & Son, Inc., the reinforcing bars will reduce almost 25% of the space formerly taken by conventional columns, giving more room for operations.



PORTABILITY of welding equipment in shipyards is vital, that's why this weldor at Bath Iron Works in Maine is using a 4-lb welding gun. Developed by Westinghouse, the gun has a built-in 1-lb wire supply in the rear of the barrel. Parallel with the weldor's head is a 20-lb control unit.



THIS resistance seam welder, manufactured by Taylor-Winfield Co., welds strip steel up to 48 in. wide on a continuous annealing line designed and built by Aetna-Standard Engineering Co., Pittsburgh. The line is in operation at Dominion Foundries and Steel, Ltd., Hamilton, Ont.

NIOBIUM, a rare and little known element, is so chemically active near its melting point—4,380 F—that Westinghouse researchers must refine it in a vacuum, as seen here. Tests are being conducted on niobium's weldability under various gas atmospheres. The metal will be used in rockets, missile and jet engines where a high-temperature structural material is needed.

CO_2 GAS SHIELDED WELDING

ON WELDING GAS COSTS

CO_2 Metal Arc Gas Shielded Welding costs approximately 1½¢ *per cubic foot of gas!* Even on a limited budget, you can afford shielded gas welding.

How satisfactory is this method? Many satisfied users indicate that the MAGS process produces welds that are equal, *or superior,* to more costly argon or helium welds. This is due to the agitating type of arc, characteristic of CO_2 welding.

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DIVISION OF GENERAL DYNAMICS CORPORATION

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- Increases metal deposition rate
- Less reworking required
- Increases operator flexibility
- Better appearance

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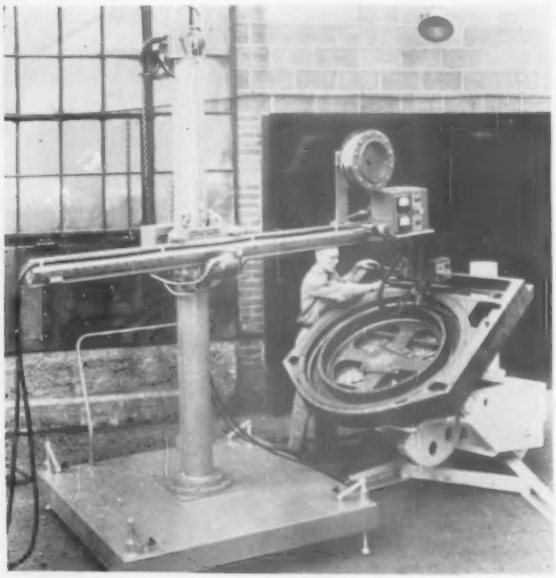
new products . . . . . USE CARD ON PAGE 91



ABOVE: This controlled atmosphere welding system includes a stainless steel interior, four-tempered glass viewing ports, centralized control panel, etc.
LEFT: Standard automatic welding heads are positioned and piloted by this automatic welding head manipulator. (See stories below.)

Manipulators

SERIES of automatic welding head manipulators is designed to position and pilot standard automatic welding heads. The manipulators are intended for use with work-holding positioners or turning fixtures. They weld straight seams up to 8 ft long and provide 8 ft of underboom clearance. *Lewis Welding & Engineering Corp.*
Circle No. 1

Regulators

SINGLE-stage, inverse-type regulators deliver heavy gas flows. Each of the 8100 series is designed to provide a higher delivery rate and to maintain more constant delivery pressure. The ribbed body ring is a new feature which makes inspection easy. Without tools, the spring case and low-pressure cavity can be opened and the diaphragm removed.

Series includes regulators engineered to meet the flow-rate demands of such operations as welding, heating, cutting, etc. *Air Reduction Co., Inc.*
Circle No. 2

Welder

SUBMERGED twin-arc welding machine performs controlled welding operations on both sides of extra large production parts, maker says. The machine welds at a rate of 80 ipm.

Occupying a floor space of about 15 ft by 15 ft, the welder is 13 ft high. The carriage is driven by a potentiometer - controlled d-c motor. Maximum up and down beam travel is 18 in. *Expert Welding Machine Co.*
Circle No. 3

Solder alloy

PASTE-type solder alloy was developed primarily for use in a new automatic soldering process, manufacturer says. The material incorporates special binders and fluxes together with pure solder alloys to form a stable paste. It is non-hardening and non-separating, manufacturer certifies. The "CW" paste series can be automatically or semi-automatically applied to the part before soldering through special dispensers in the production line. *Fusion Engineering Co.*
Circle No. 4

Inspection kit

SPRAY-ON fluorescent penetrant inspection kit is for locating cracks, pores and leaks in non-magnetic materials. The portable kit combines the most sensitive of the fluorescent penetrants with a pressurized spray can. Included in the case are: spray cans of cleaner, penetrant and developer; a 100-watt high intensity black light; cleaning cloths; wire brush and detailed instructions. *Magnaflux Corp.*
Circle No. 5

Weld system

PACKAGED controlled atmosphere welding systems are available with complete stainless steel interior, leveling screws, four-tempered glass viewing ports, two lighting ports, hinged flange cover, six bellows-type gloves, centralized control panel, cold trap, electronic measurement instruments, quick opening clamps and enclosed pumping console.

Many optional features are available, including inert gas manifolds, dynamic braking, post-mounted machine torch, manual torch, etc. *L&B Welding Equipment Inc.*
Circle No. 6

Fixture clamp

HEAVY-duty 6-in. fixture clamp has an additional base bracket to give it greater strength and rigidity. It is cadmium plated and made from high tensile steel. Clamp is available with a base plate and T-bolt for quick machine application. *Saxton Mfg. Co.*
Circle No. 7

Molding compound

PLASTIC thermosetting flexible molding compound for casting cold setting ceramics and plastics. Originally developed for making molds for precision casting cold setting ceramic tooling. *Technion Design & Mfg. Co., Inc.*
Circle No. 8

Welder

SPECIAL welder is a six-station dial index, used to weld various types of jack body assemblies. In the first station an operator presses the lower half of the jack body into a nesting die. In indexing to the second station, the outboard locators cam in to engage the square hole in the jack body where the ratchet shaft eventually goes.

In the third station a compound hydraulic portable gun swings in to weld the jack handle receptacle. A 250 kva 12 in. throat press welder has a movable lower ram on which the remaining projections are welded at the fourth station. The average number of projections on the main body is four.

In the fifth station the hollow end of the hinge pin is swedged. An automatic arm with an electro-magnet swings down to engage the part in the final station. By this time the outboard locators of the fixture are cammed out, allowing the electro-magnet to lift the welded assembly to upright where a conveyor will automatically be synchronized to pick up the part and transfer it to the paint line. *Progressive Welder Sales Co.*

Circle No. 9

Spot welder

AIR-operated, press-type, single-phase spot welder is number one in a series of frame sizes ranging from 1 SP through 5 SP. Available in 30, 50 and 75 kva at 50% duty cycle, the 1 SP can be furnished with 18, 24, 30, 36 and 42 in. throat depths. Electrode force up to 1,575 lb is provided at 80 psi line pressure. The machine includes pneumatic, double acting cylinder head, micro-finish cylinder walls and molded, and synthetic cup seals to reduce friction. *Sciaky Bros., Inc.*

Circle No. 10

ULTRASONIC WELDING*

SONOWELD®
AN IMPORTANT
NEW WELDING CONCEPT

Shown above is SONOWELD Model No. W-2000-SR-57-10, one of several sizes of units. At left below is an actual size photograph showing a .002 aluminum foil lead ultrasonically welded to an aluminum capacitor can.

Ultrasonic Welding Without Fusion

SONOWELD is a revolutionary new metal-joining technique which uses vibratory or high-frequency sonic energy to produce a solid-state metallurgical bond between similar or dissimilar metals.

It is superior to usual methods of welding in many applications. It is applicable to industrial use with metals and shapes heretofore impossible or difficult to weld.

There is no arc, spark, sputter, or contamination with SONOWELD equipment. Welding is done at relatively low temperatures, with low clamping force, negligible deformation. Joints are excellent in a wide variety of metals and metal alloys.

Write for more information. Tell us your specific welding problem or application.

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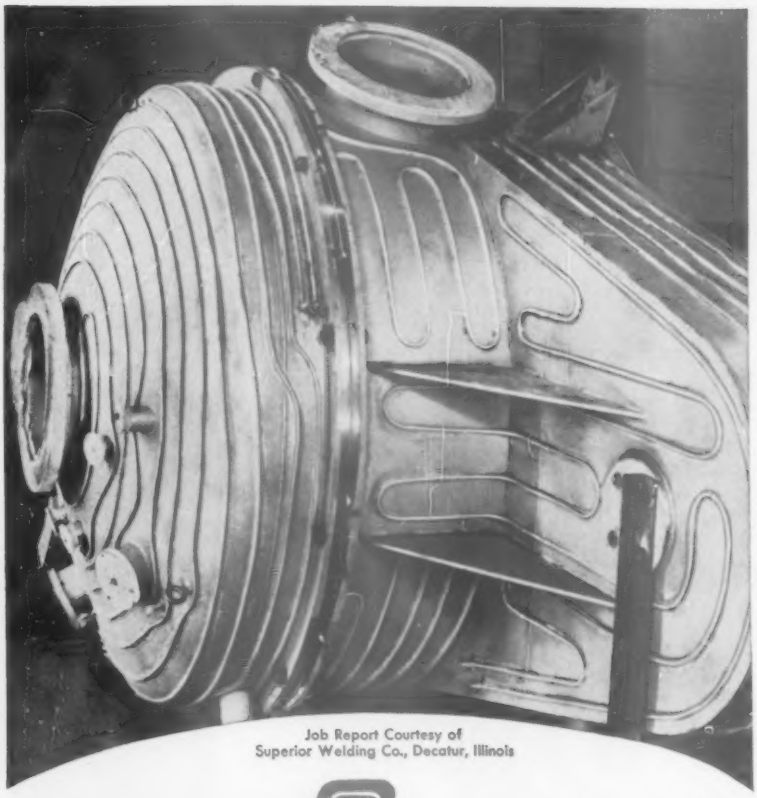
A SUBSIDIARY OF AEROPROJECTS, INCORPORATED
WEST CHESTER, PENNSYLVANIA
Manufacturers of Ultrasonic Metal-Joining Equipment
SONOWELD® • SONOBRAZE® • SONOSOLDER

*Ultrasonic welding — originated and developed by Aeroprojects Incorporated

When stainless welds must be VACUUM TIGHT



Job Report Courtesy of
Superior Welding Co., Decatur, Illinois

WELD WITH ARCOS

STAINLESS ELECTRODES

Shown here is a stainless steel furnace body of type 304 ELC for use under very high vacuum conditions in the casting of metals where exceptional purity is required. Arcos Chromend K-LC Stainless Electrodes were used because Arcos electrodes not only assured the proper weld metal chemistry, but also the necessary soundness to insure vacuum tight welds. Save money and future problems with long-lasting Arcos-produced welds. ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.

Soldering

AUTOMATION soldering combines the use of new paste-type solder alloys made for special automatic dispenser with automatic heating equipment. Solder powders are combined with special fluxes and neutral binders to form a stable paste. Using a dispenser, the paste is pre-placed in the joint area before soldering. The dispenser meters the exact amount of paste up to 1/100 oz. in dots, stripes or special patterns. Each dispenser deposits at a rate of 8,000 dots per hour and with variations up to 15,000 dots per hour. *Fusion Engineering Co.*

Circle No. 11

Nibbler

PORTABLE nibbler cuts even titanium without distortion, claims its manufacturer. The tool cuts all types of nonferrous metals, leaving an edge ready for fabricating. It cuts up to 55 in. per minute. The 13-lb tool's minimum radius is 6 in., but for a shorter 3-in. radius a special die holder is available. *Fenway Machine Co.*

Circle No. 12

Arc welder

LIGHT industrial arc welder is for general purpose applications. The 180-amp, a-c welder features a shunt design, pinpoint current settings and a large current scale. The case is a blue "hammer-tone" finish over a heavy prime coat. Current changes are made by turning the top-mounted handle. It raises or lowers the shunt, changing the output current. Silicone insulation is used on modern copper coil windings. *Birdsell Mfg. Co., Inc.*

Circle No. 13

Flexible shaft

DESIGNED to allow complete visibility of the cutting or beveling operation, a shaft is made from a length of flexible tubing with a crank handle attached to one end of the tubing and the other end attached to the crank pinion on the machine. As the operator turns the crank, the ring gear is put in motion and the torch begins its revolution around the pipe. *H&M Pipe Beveling Machine Co.*

Circle No. 14

Positioner

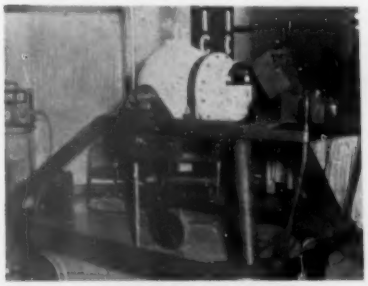
UNIT comes complete with cones, motor and welding nozzle, etc., ready to rebuild tractor rolls and idlers. The spindle head tilts through 135 deg for rim welding or flange and running surface build-up. It is portable, has a large flux hopper, flux metering control, nozzle tilt adjustment and telescoping centering cones. *Wincar Welders.*

Circle No. 15

Swing clamp

FOR quick maneuvering, a new swing clamp assembly uses a spring loaded shaft to enable the clamp to swing quickly and easily out of way of fixture and work. It is especially designed for safe work hold and fast clamp release in restricted spaces. *Jergens Tool Specialty Co.*

Circle No. 16

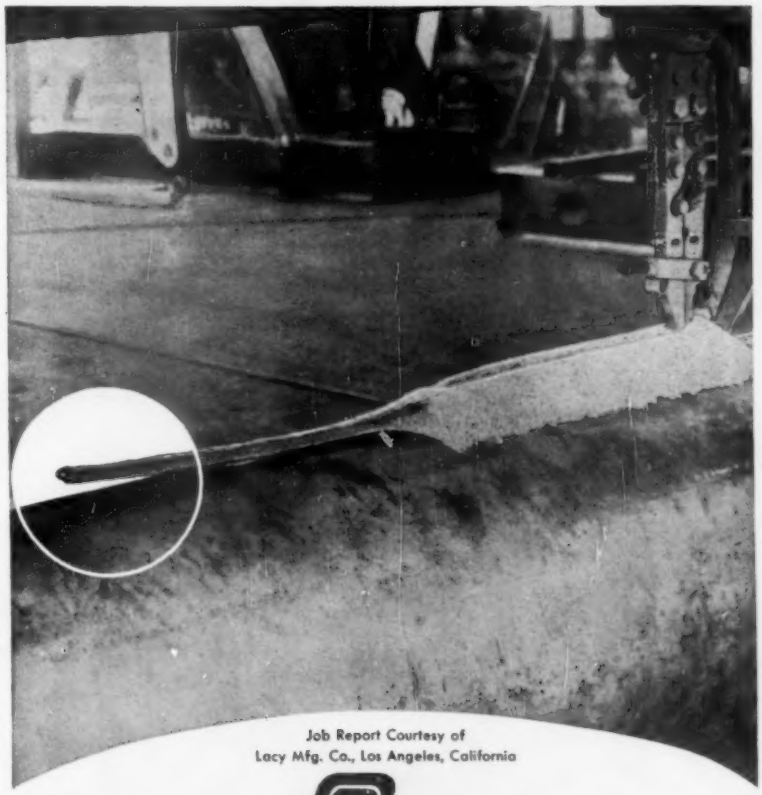


Radiographic unit

RADIOGRAPHIC unit, "C-750 Hot Spot," contains 750 curies Cobalt 60. Radiation is equivalent to 2 to 3 million-bolt X-rays. Unit operated by remote electric controls. *Picker X-Ray Corp.*

Circle No. 17

Now, submerged arc stainless welds with slag that "pops-off"



Job Report Courtesy of
Lacy Mfg. Co., Los Angeles, California

WELD WITH ARCOS

Stainless Wire and Arcosite Flux

Arcos research and experience with stainless weld metal now pays you *another dividend*—for the first time . . . consistently *self removing slag!* On the job above, submerged arc welding of a section of pipe for petroleum equipment, two passes were made with $\frac{1}{8}$" coiled CHROMENAR KMo Stainless Wire and ARCOSITE S-4 Flux. As the photo shows, the cooling slag is lifting free by itself . . . leaving a clean, smooth bead. Think what this can mean to you on your own submerged arc welding jobs . . . saving time and money . . . better welds than ever before. ARCOS CORPORATION, 1500 S. 50th St., Philadelphia 43, Pa.

How Oliver Corporation Saves $35.00 per man with...

Riegel
WELDER'S
GLOVES

"The Riegel No. 99 Heavy Welder lasts six weeks against two weeks for the glove we used formerly. The men tell us it's more comfortable and cooler."

So reports Mr. Richard Thornell, whose switch to Riegel now saves $35.00 yearly per man at Oliver Corporation, Springfield, Ohio.

No. 99 facts: Heavy but flexible "flextan" welders' leather, gunn cut, wing thumb. Extra roomy, extra long. One-piece back, wool-insulated . . . all exposed seams welted . . . full protection against heat and sparks.

Riegel has the service you want, too . . . industrial specialists to help select the right style . . . eight warehouses to speed delivery. Write or phone today.

Spot Welder No. 89 | Service Welder No. 199 | Welder's Mitten No. 98

INDUSTRIAL GLOVE SALES
RIEGEL TEXTILE CORPORATION
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Riegel
GLOVES THAT WEAR ON
WHERE OTHERS WEAR OUT

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Detroit • Greenville, Ala.
Los Angeles
New York (Paterson, N. J.)
Oklahoma City
Portland, Ore.

HENRY Harnischfeger, executive vice president of Harnischfeger Corp., Milwaukee, puts the world's largest power elevating positioner through its paces.

Weld positioner

WELDMENTS up to 80,000 lb can be manipulated with a new power elevating welding positioner, claimed to be the world's largest. The machine is available with either single or two-speed table rotation, and can rotate workpieces through 360 deg from 0.0135 rpm to 0.31 rpm, elevate and lower 5 ft and tilt 135 deg. The positioner does not require counterweights. *Harnischfeger Corp.*

Circle No. 18

Joining material

SIMILAR and dissimilar non-ferrous metals can be joined with a new material called "InterAct." Copper and aluminum can now be joined chemically, the manufacturer claims. The new material forms a permanent chemical bond through ion exchange between such materials as magnesium, titanium, brass, zinc, silver and gold. *Intertectics, Inc.*

Circle No. 19

Gas welding

TIG welding unit for factory installation on Hobart's motor generator arc welders is designed for welding application where low ripple (1% to 2%) d-c welding current is required to weld such metals as stainless steel, high carbon steel, cast iron, silicon bronze, deoxidized copper, and silver. The high frequency unit, complete with gas and water valves, is mounted at left of welder control panel. *Hobart Brothers Co.*

Circle No. 20

Automatic inspection

SPECIALLY-designed unit for automatic production inspection for small steel and iron parts permits easy use of water bath materials. Magnetization may be both circular and longitudinal, simultaneous or separate, for the detection of both longitudinal and transverse defects. Conveyorized inspection unit can be added to speed inspection and provide automatic demagnetization. *Magnaflux Corp.*

Circle No. 21

Power rectifiers

FOR all types of power applications, three new silicon power-rectifier diodes are hermetically-sealed silicon-rectifying cells providing d-c forward currents up to 1.6 amp with a maximum peak inverse voltage up to 800 volts. *Westinghouse Electric Co.*

Circle No. 22

Hardfacing unit

SEMIAUTOMATIC hardfacing wire feed unit is light weight and portable. Recommended for use with the unit is a hardfacing wire pack offering tension-free wire feed and easy wire change-over. The unit-wire combination aids equipment maintenance, manufacturer says. Unit feeds wire automatically at pre-selected rate. Wires offered include a nickel-manganese type, and a varied group of five types ranging from a machinable buildup material to a hardfacing alloy with severe-abrasion, medium-impact resistance. *Alloy Rods Co.*

Circle No. 23

Notcher

TWO-stage notcher is used for induction welding or brazing. It has two sets of punches and dies so that both the first and second cuts of the desired notch are made with a single press downstroke.

The left-hand punch makes the first cut with tubing stock held parallel to the base as it is fed into the die. The right hand punch makes the second or final cut with the tubing angled downward when fed into the die. *Vogel Tool and Die Corp.*

Circle No. 24

Do ALL your hardsurfacing

with just 7 Job-Graded Ranite Rods!

Just seven grades meet all wear conditions—regardless of whether the wear is caused by shattering impact, severe abrasion, or some combination of impact and abrasion.

Ranite is "the weldor's rod"... rated "easiest to use" by a wide margin.

They're easiest of all to select, too.
They're Color-Coded and the colors are keyed to the exclusive Ranite Select-O-Graph Guide. You can pick the right rod for any job with no guesswork.

GET YOUR NEW FREE Ranite Select-O-Graph Guide, in convenient shirt pocket size; ask your Ranite distributor or write direct TODAY.

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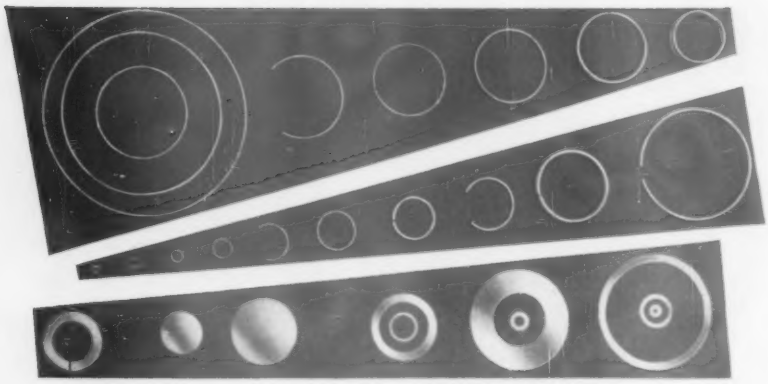

Pre-formed for your needs

GB *PRE-FORMED* Silver Brazing Alloys are available in the size and shape your job requires. Pre-formed shapes, like those shown, are designed for the joint. They assure strong, safe connections with a measured, minimum amount of alloy to save you time and money.

Write today for facts about efficient, economical GB 88 Flux and GB Silver Brazing Alloys in random coils, strip, pre-formed rings or special shapes.

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City_____ State_____

Automatic welding

CAPABLE of welding collars on each end of a tube at the rate of 360 welds an hour, an inert-gas type welder uses 0.045 electrode at 72 in. per minute. The unit can also be used as a multiple station indexing plate, and with interchangeable fixtures it can perform several different operations. *Tri-City Tool and Machinery Corp.*

Circle No. 25

Clamping device

FAST-acting clamp has a cam trigger that sets it at five distinct positions and locks in place. Known as the "Wedgelock Klip-Klamp," it is adjustable and released by flipping cam lever. Made of extra-heavy spring wire, metal parts are cadmium plated to resist rust. Rubber jaws are replaceable. Length is 4-5/8 in., jaw depth is 2 in. *Wedgelock Corp.*

Circle No. 26

Motor starter

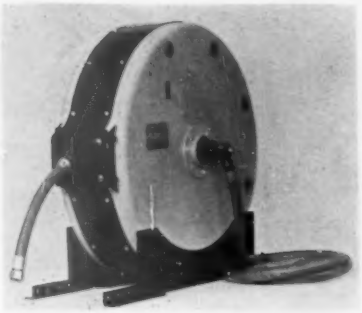
MOTOR starting fluid will start all gasoline and diesel engines, even in —65 F, manufacturer claims. The new formula has low-ether content and contains a built-in lubricant for upper cylinder area during initial starting. *Wilco Co.*

Circle No. 27

Machine head

SPECIFICALLY designed for the heavier, production applications of automatic machine welding, a new head has a capacity for heavy welding wires. Aluminum wires of from 3/64 to 1/8 in., and hard wires from 0.045 to 1/8 in. can be fed at any rate up to 600 ipm. Wire feed speed is adjustable with a calibrated governor which regulates the 1/3-hp wire-drive motor. The machine barrel is rated at 600 amp, on a 100% duty cycle. The welding head can be rotated through 360 deg for work in any position. *Air Reduction Sales Co.*

Circle No. 28



Industrial reel

WITH a capacity of 50 ft of ½ in. ID single hose, a new industrial reel is designed for use with compressed air, industrial gases, liquids and chemicals. The unit features the universal-type mounting bracket which permits easy installation on wall, floor, ceiling or mobile equipment. Heavy-duty clock-type spring provides automatic retraction into metal housing when the hose is not in use. The unit is finished in baked enamel. *United Specialties, Inc.*

Circle No. 29

Weld Positioners

250-POUND capacity positioners boast 165 deg of manual table tilt (30 deg back tilts). Variable speed table is powered by ¼ hp speed transmission. Positioners are 33 in. long, 25½ in. wide, 23 in. high and can be mounted on a bench or easily moved. *Pandjiris Weldment Co.*

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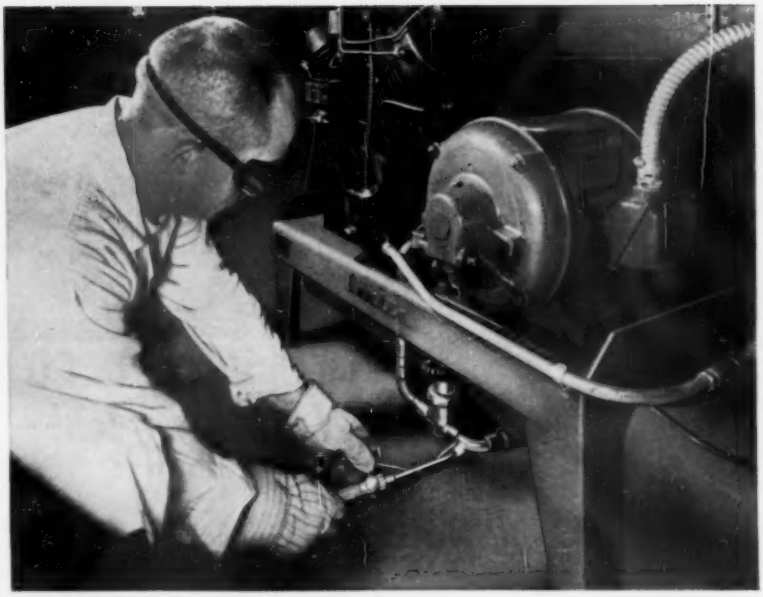

Operator using SMITH "Handi-Heet" torch to repair fittings on air-conditioning unit.

NEW...air-acetylene torch assures fast, economical heat

USES ATMOSPHERIC AIR and acetylene only—*needs no oxygen*. With this new "Handi-Heet" Soldering Torch Kit, refrigeration and air conditioning men, plumbers, auto repair men, etc., have an ideal source of fast, clean, economical heat. You can solder, braze, lead, thaw, and do dozens of other every-day jobs. SMITH'S "Handi-Heet" Kits are complete units—ready to attach to any acetylene tank and go to work. Models available for all commercial tanks, and styles "B," "P.O.L." and "MC" tanks.

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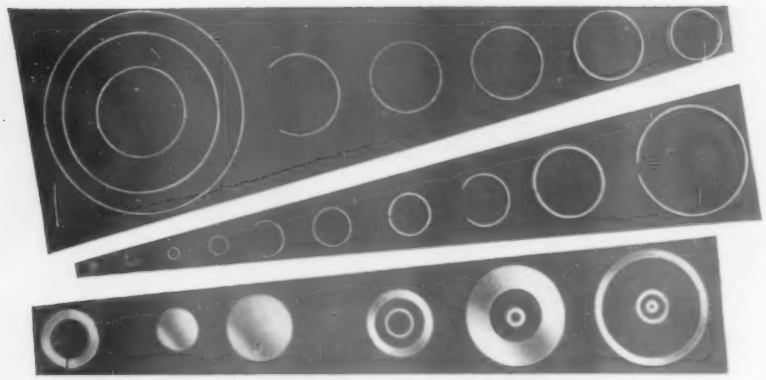

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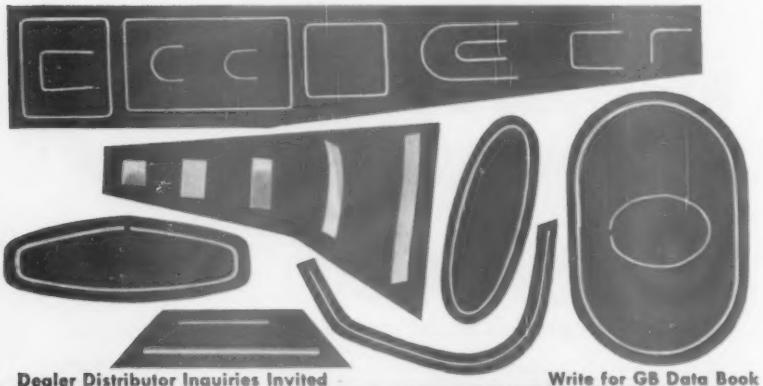

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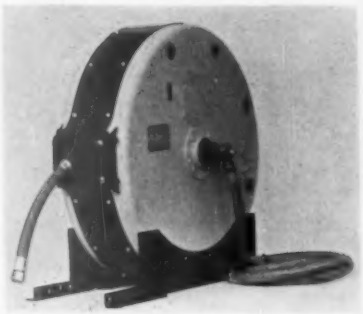

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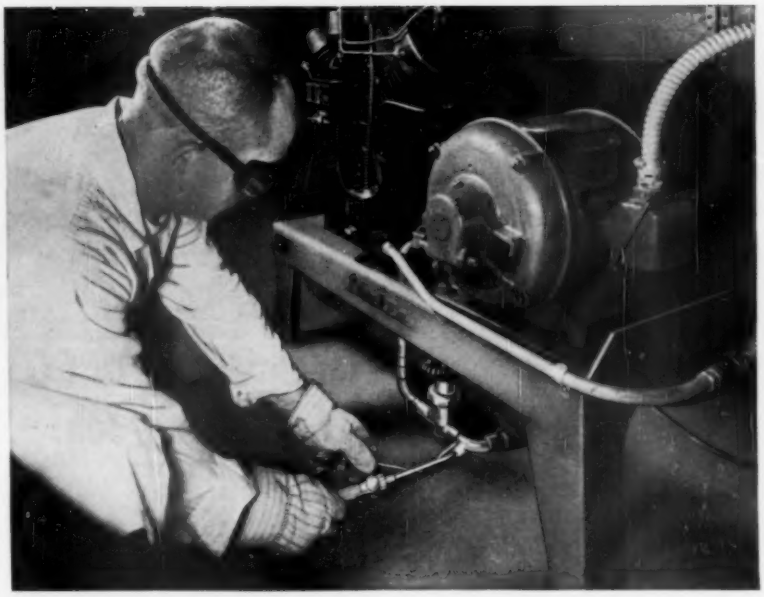

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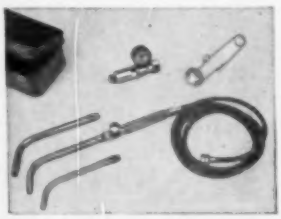

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- NO MORE LOSS OF TIME
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—that's all we ask, and you'll find as others have, that no Welder will part with it—once he tries it! See your Welding Supply Distributor TODAY — or write us for name of one near you—don't put it off; costs only $9.95.

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Welder

SEMI-AUTOMATIC welding machine is for hardfacing or mild steel welding. It feeds both tubular and solid wires from a-c or d-c welders. Only two electrical connections needed, firm claims—clip electrode cable to welder and ground cable to work piece. An inch switch is for wire advance and wire retract. Dynamic brake prevents wire overfeed. *Auto Arc-Weld Mfg. Co.*

Circle No. 33

X-ray stand

TELESCOPIC stand lowers, raises and positions Fedrex X-ray tubeheads with a pedal and lever. One man can raise the heaviest tubehead to a focus height of 7 ft 7 in. The lowest focus height is 2 ft.

The tubehead can be rotated to any position around its longitudinal and latitudinal axis. Furnished with handles for positioning the head, stand has two fixed front wheels and two caster wheels. *Machinery & Welder Corp.*

Circle No. 34

Electrode

MILD-steel, iron-powder type electrode deposits metal at the rate of 17 lb per hour. This rate is accomplished through the use of an extra heavy iron-powder coating together with increased machine settings, manufacturer explains.

The steady spray-type transfer and the deep shield maintained permit flexibility of arc length to accommodate various welding techniques.

Electrode is designed for making positioned fillet or lap welds. Single pass fillets as large as ½ in. may be produced, as well as flat groove joints. *Air Reduction Sales Co.*

Circle No. 35

Iron; "Design for welding," Omer W. Blodgett, Lincoln Electric and Jay Bland, Standard Oil Co.

"Recent developments in power sources for welding," Warren Sykes, Miller Electric Mfg. Co.; "New techniques in welding aluminum," F. R. Baysinger, Kaiser Aluminum and Chemical Corp.; "Automatic resistance welding applications," Thomas C. Falter, Frigidaire Div., General Motors.

"Manual electrodes for code-governed weldments," Amel R. Meyer, Graver Tank and Mfg. Co.; "A new CO_2 welding process," A. F. Chouinard, National Cylinder Gas Co., and "Nickel alloy welding of dissimilar alloys by arc and inert-gas-shielded processes," K. M. Spicer, International Nickel Co.

Airco opens Denver store

Air Reduction Sales Co. recently opened a new store in Denver. It will supply argon, helium, acetylene and electric welding equipment, electrodes and supplies. The new outlet offers technical assistance and equipment repair service.

Handy & Harman adds fifth plant

Covering more than 23,000 sq ft, Handy & Harman's new plant at El Monte, Calif., is scheduled to begin operation in February. Complete with office, laboratory, refinery, operating area and warehouse, the plant is a one-story building of tilt-up panel construction.

The laboratory will be equipped for precision analysis and weighing of gold, silver, platinum, etc. In the refinery, precious metals will be reclaimed from scrap and waste. When the new plant opens, Handy & Harman will close its Los Angeles building.

SALES force of the new Mexico City affiliate of Eutectic Welding Alloy Corp. Mrs. Roma Garzione Rao (center), vice-president of Pan American Eutectic Welding, supervised setting up the new branch. At her right is Marco F. Ayora and at her left, John B. Knight, Jr. (See story below.)

Munson speaks at MCA meet

Chairman of the board of Air Reduction Co., Inc., Charles S. Munson, recently addressed the Manufacturing Chemists' Association, Inc., at its meeting in New York City.

Brazil gets ready for construction

Brazil will get a construction equipment industry with the combined efforts of Harnischfeger, a subsidiary of Milwaukee's Harnischfeger Corp., and Equipamentos Industriais Villares, S.A., Sao Paulo, Brazil. Together, they will produce P&H power shovels and truck cranes. The machines will be used in Brazil's highway construction and in building hydro-electric power plants.

The Sao Paulo firm is building a new plant to house crane fabrication. The plant should be in production by early 1958, Harnischfeger reports.

Eutectic moves into Mexico

Eutectic Welding Alloys Corp., Flushing, N.Y., recently opened a new affiliate in Mexico City, Compania Mexicana De Soldaduras Eutectic A Baja Temperatura S. A.

Eutectic President Rene Wasserman explained the move by stating, "With facilities in Mexico City we will now be in a position to provide the prompt delivery and service to Mexican industry that we consider so vital." A branch of the firm's Institute has been set up to train Mexican weldors in its "low heat input" process.

Combine to build ultrasonic cleaner

G. S. Blakeslee & Co., Chicago, will combine talents with Branson Ultrasonic Corp., Stamford, Conn., to design, sell and service a line of ultrasonic cleaning machines. Blakeslee manufactures industrial washers and degreasing machines; Branson is in the ultrasonic field.

Norelco sets up training school

To teach employees how to handle complex field problems and the firm's instruments, Philips Electronics, Inc., has started a sales training school at its Mount Vernon, N.Y., plant. Salesmen were school-bound December 2 through 6. The firm expects to repeat the training course each year.

U. S. Industries merges divisions

Chicago Steel Tank Co., a division of U. S. Industries, Inc., New York City, has been merged with another USI division, Solar Permanent Co., Tomahawk, Wis. A. Sternberg will direct the division from offices in Chicago and Tomahawk.

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WHAT COULD YOU DO with an extra $25? Start planning now, because you can easily earn that, and more—on weekends, evenings, working whenever you please. WELDING ENGINEER would like to reach your area. You are familiar with *WE;* surely you know many persons who would like to subscribe, once they see the magazine.

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E. A. HOBART, president of Hobart Brothers Co., points out a 500,000 lb floating sand separator used in the firm's mining operations in Florida. See story below.

Hobart speaks to Dayton AWS

Mining operations which started a new industry in Florida was the topic covered by E. A. Hobart, president of Hobart Bros. Co., at a recent talk before the Dayton, Ohio section of the American Welding Society.

Rutile deposits, used for coating arc welding electrodes, were discovered along an ancient shore line on the Florida coast. Hobart extracts and separates four rare minerals at its mining site between Vero Beach and Winter Beach. The firm controls the entire mining cycle, he said. He illustrated his talk with color slides showing the complete operation.

Metal & Thermit sells thermit line

Reade Mfg. Co., Inc. of Jersey City, N.J. recently bought the thermit welding business from Metal & Thermit Corp., New York. H. E. Martin, M&T president, stated that the firm's over-all growth plans call for concentration in the production and marketing of chemicals, metals and arc welding electrodes and equipment.

On Dec. 2, Reade took over supply materials and equipment for thermit welding as well as technical assistance on problems. Thermit welding is used to repair and fabricate heavy equipment and for repetitive welding, such as the joining of rails into continuous lengths.

ASM rounds up for western meet

The first Annual Western Welding, Brazing and Heat-Treating Conference will be held March 27 and 28 in Menlo Park, Calif. Sponsoring the event is the Golden Gate chapter of the American Society for Metals. Representatives from 11 western states will tackle joining and heat-treating problems.

Announce 45th CGA meeting

The 45th annual meeting of the Compressed Gas Association, Inc., will be held Jan. 20 and 21 at the Waldorf-Astoria, New York. Papers include: "The settled pressure characteristics of acetylene cylinders," by Roger A. Clemons, Linde Co., and "Impact testing of combustibles in liquid oxygen," by F. C. Saacke, Air Reduction Co.

Metal repair firms organize nationally

The recently-organized American Metals Repair Association, Pittsburgh, is made up of firms that repair machinery and metal parts used in heavy industry. Canadian firms are included in the organization.

A series of preliminary conferences in the U.S. and Canada has recently been completed. The AMRA hopes to raise standards in the industry, promote research and protect customers against unqualified operators through a system of licensing of qualified firms and personnel.

Ryan expands electronics

The electronics section of Ryan Aeronautical Co. will move into a 30,000 sq ft Kearny Mesa, Calif., plant—leaving a two-year old, 10,000-sq ft building for expansion of other Ryan divisions. The new building is near the new Convair Astronautics Div. plant rising on Kearny Mesa.

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Airco completes Texas plant

Arlington, Texas—between Dallas and Fort Worth—is the site of Air Reduction Sales Co.'s new $400,000 gas-producing plant. Primarily designed to produce high-purity oxygen and nitrogen, the plant also includes centralized stores and warehouse facilities for other major Airco products—acetylene, argon, calcium carbide and welding supplies and equipment.

Warehouse and office facilities have been built for Airco's Ohio Chemical and Surgical Equipment Co. division. The gas-producing plant at Dallas has been moved to the new site. Harry Melick, formerly in charge of the Dallas plant, will supervise the new facility.

DuPont develops niobium for jets

Niobium metal of unusual purity, and alloys of high-strength niobium have been developed by DuPont de Nemours Co., Inc., to help solve design problems in jet engines, guided missiles and atomic reactors, that firm reports.

DuPont is working with Thompson Products, Inc., Cleveland, to step up progress of the metal. Thompson will develop forging and other fabrication techniques for the alloys.

Eutectic opens LA warehouse

A new warehouse-service center has been opened in Los Angeles by Eutectic Welding Alloys Corp., Flushing, N.Y. R. C. Wilcox will operate the center. The firm's welding research and development laboratories will be open to weldors in the area.

The new service center will also be headquarters for a Eutectic Welding Institute, and the firm's technical information service.

Keep Plant Air CLEAR of Welding Fumes

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean, healthful atmosphere. Harmful fumes, heat and smoke are eliminated *at their source*, before they have a chance to spread throughout the shop. This lessens fatigue . . . improves working conditions . . . paves the way for increased plant production. Ruemelin Fume Collectors are approved by Industrial Commissions and insurance companies. Thousands in service. Available with 9 ft., 15 ft., 17 ft. and 20 ft. reach. Write for Bulletin No. 37-E.

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ARF hits record with '57 research

Armour Research Foundation of Illinois Institute of Technology of Chicago conducted a record volume of research in the 1956-57 fiscal year. Gross volume advanced to $14,067,534—an increase of more than $2 million over last year, said Dr. Haldon A. Leedy, ARF director.

Film explains labor law

"You and Labor Law," is a two-part, 30-minute sound slidefilm which is sold by the Employers Labor Relations Information Committee, Inc., 33 E. 48th St., New York 17, N. Y.

The film covers the history, purpose and principles behind our present labor law. Part one shows the evolution of labor law philosophy. The second part shows present labor law in action.

Pennsalt selects Canadian site

On a 10-acre area near Oakville, Ont., Pennsalt Chemicals Corp., has built its first Canadian plant. As Pennsalt Chemicals of Canada, Ltd., the new unit will operate as a wholly-owned subsidiary.

TILLMAN Gloves—Garments

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BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

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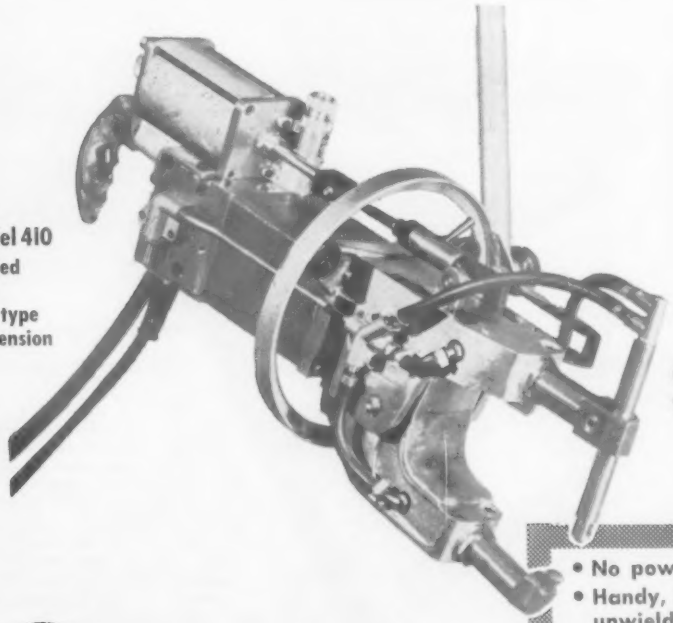
NEW

ARO Model 410

Air operated gun with "Ski-lift" type gyro suspension



ARO

Portable

SPOT WELDERS

- No power loss. Transformer built-in
- Handy, maneuverable—no heavy, unwieldly cables
- Usually costs about half as much as gun-plus-transformer
- Works on existing power lines
- Automatic timing

Illustrated Literature on Request

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DIVISION OF

GUTHERY MACHINE TOOL CORPORATION

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Dealer Inquiries Invited

COMING EVENTS

JAN. 20-21: 45th Annual Meeting of Compressed Gas Association, Inc., Waldorf-Astoria, New York.

JAN. 27-29: Ninth National Plant Maintenance & Engineering Show, International Amphitheatre, Chicago.

JAN. 29-30: Midwest Welding Conference, Chicago.

FEB. 10-14: American Society for Testing Materials committee week, Hotel Statler, St. Louis.

MARCH 17-21: 1958 International Atomic Exposition trade show in conjunction with 1958 Nuclear Congress, International Amphitheatre, Chicago.

MARCH 19-21: Fifty-eighth Annual Convention, International Acetylene Association, Bellevue Stratford Hotel, Philadelphia.

MARCH 27-28: First Annual Western Welding, Brazing and Heat-Treating Conference, Menlo Park, Calif.

APRIL 14-18: Sixth Spring and Thirty-ninth Annual Meeting, American Welding Society with American Society of Mechanical Engineers Conference, Hotel Statler, St. Louis.

APRIL 15-17: Sixth Annual Welding Show, American Welding Society, Kiel Auditorium, St. Louis.

MAY 5-8: Fourteenth Annual Convention, National Welding Supply Association, Americana Hotel, Miami Beach, Fla.

MAY 12-16: Southwestern Metal Exposition, State Fair Park, Dallas.

MAY 15-16: Third Annual Welding Exposition, Utah State University, Logan, Utah.

JUNE 22-27: American Society for Testing Materials, Hotel Statler, Boston.

Valve standards now available

The 1957 edition of "American Standard B57.1 - 1957 — Canadian Standard B96-1957, Compressed Gas Cylinder Valve Outlet and Inlet Connections" is now available, the Compressed Gas Association reports.

Distributor appointments

Acoustica Associates, Inc., Mineola, N.Y.: Allied Components, Inc., Dallas; Puro Chemicals, Inc., Cleveland; Don R. Lind, Wichita, Kan.; Wild & Associates, Roslyn, N.Y.

Harnischfeger Corp., Milwaukee: Delta Oxygen Co., Inc., Memphis.

Metal & Thermit Corp., New York City: Victor Equipment Co., San Francisco, Ace Welding Supply Co., Oklahoma City, Okla.; Webb City Metal Products Co., Tulsa; Alabama Oxygen Co., Birmingham; Monson Welding Sales, Inc., Syracuse, N. Y.

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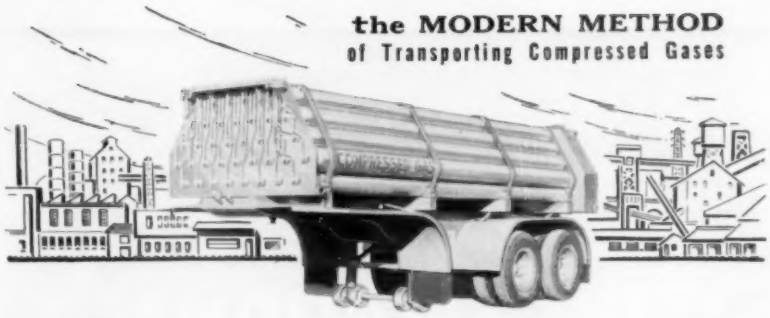
of Transporting Compressed Gases



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Alloys and Fluxes for Joining ALL METALS ALL METHODS
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SOLDERING · BRAZING · WELDING
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ADVANCED "Jet Flux" System auto dispenser and brazing liquid

Melds smoothly into brazing operations. Permits elimination of paste flux. Ruggedly compact, sized for work-week without refilling. Attach to fuel line on truck or station . . .

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Includes wire and flux. The only good way to keep silver solder safe and ready for maintenance and service men. Six choices from 3 kinds, 2 lengths. Save time and money.

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REQUEST COMPLETE LIST OF THESE PRODUCTS FOR PROBLEM SOLUTIONS

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

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WELDING MACHINERY ENGINEERED AND MANUFACTURED TO ORDER AND SKILLFULLY AUTOMATED TO MEET INDUSTRY'S MOST EXACTING AND RAPIDLY CHANGING PRODUCTION TOOLING REQUIREMENTS

EXPERIENCE · INGENUITY · INTEGRITY

ESTABLISHED 1936

Former General Electric Welding Department member *Gordon E. Cossaboom* is new product service coordinator for Westinghouse Electric Corp., Pittsburgh.

Joseph DeSanto is the new manager of welding sales for the Chicago section of Champion Rivet Co.

John B. Kendall was recently elected vice president of Delta Welder Corp., Detroit. He was formerly in charge of Ford's Chicago stamping plant.

New president and general manager of Progressive Welder Sales Co., Pontiac, Mich., is *Ray W. Heiden. Harry Rose,* former chief engineer, was appointed vice president and national sales manager. Heiden fills the vacancy created by the death of former president and founder, Fred H. Johnson.

Victor Equipment Co., San Francisco, has named Richard J. Deveau as its new east coast factory representative.

The Chemical and Metallurgical Div. of Sylvania Electric Products, Inc., New York, recently promoted three division personnel. *Gerald L. Moran* is the new division general manager; *Calvin J. Sparrow* was named to the newly-created manufacturing manager position; *Paul W. Felten* is now division chief engineer. Sylvania also announced appointment of *Henry McConnell* as wire plant manager in Warren, Pa., with *Harlod T. Bright* as his new manufacturing superintendent.

Kenneth L. Madden is new plant manager at Electronic Welding Co., Burbank, Calif. A former welding engineer at Boeing Aircraft, he will have direct supervision of commercial and military contract fabrication programs.

New general sales manager of Chicago Steel Tank Co. is *Robert L. Allen*. Before joining the firm, a division of U. S. Industries, Inc., he was with Fritz W. Glitsch & Sons, Inc., Houston.

Wall Colmonoy Corp., Detroit, has appointed *Ralph H. Ehlers* as engineering representative for its Morrisville, Pa., plant.

Stanley I. Roberts, welding engineer, has transferred from the San Francisco Naval Shipyard to the Portsmouth, Maine, shipyard, where he is in the shop division of the production department. He was serving as chairman of the San Francisco section of AWS when he was transferred.

Fred J. Purdy fills the newly-created post of manager of marketing for Westinghouse's welding department. He was sales manager. Purdy will headquarter in Buffalo.

Arthur L. Krasnow has been appointed eastern region sales manager for the Nuclear Systems Div. of Budd Co., Philadelphia.

The welding sales organization of Metal & Thermit Corp., New York, has added *Burton A. Wells* to its Dallas, Texas, area.

Eight vice presidents were elected recently at the High Voltage Engineering Corp., Burlington, Mass. They are: *John M. McCarthy*, comptroller; *Lloyd R. McIntosh*, general manager; *E. Alfred Burrill*, sales manager; *George E. Bulwinkle*, production manager; *John L. Danforth*, mechanical engineering director; *A. John Gale*, applied physics director; *John C. Nygard*, electrical engineering director and *John H. Scotney*, installation and service manager. *Charles C. Hughes*, *Robert P. Gow* and *Henry Lodge* were added to the sales engineering staff.

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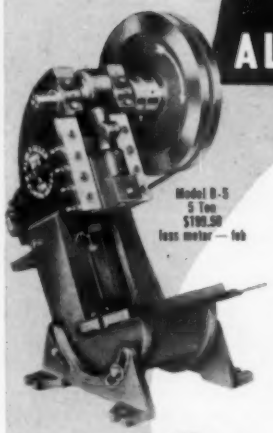
ALLEN PUNCH PRESSES

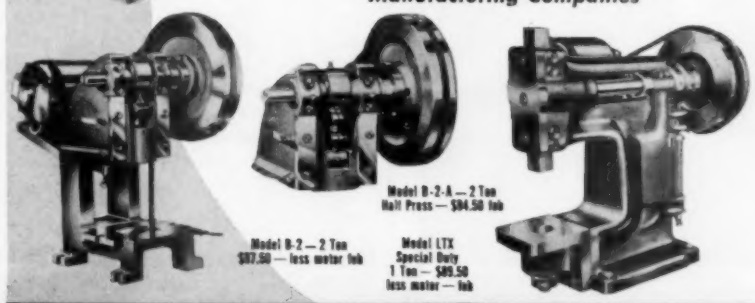
Moderate in Price
Powerful
Dependable and Economical
Fully Guaranteed



164 Different Model Combinations 1 to 5 Ton Capacities

See your Supply Dealer or write for Catalog giving complete information, specifications and prices on our line of Bench Type Punch Presses.

Thousands in use by Leading Manufacturing Companies



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Weighs only 9 ozs. Pocket size.

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Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

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has everything for
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The complete one-order supplier for you!
• Tools • Machinery • Finishes
• Over 400 Casting Designs—PLUS Selling aids!

Ornamental Iron Finish—a plastic-base paint especially developed for painting ornamental metal work. Costs no more than ordinary metal paints. Money-back guarantee. Colors: Gloss Black, Satin Black, White, Primrose Yellow, Natural Gray, Warm Gray, Green.

50-gal. drum	$4.26 per gal.
5-gal. can	4.36 per gal.
1-gal. can	4.46 ea.

"CS" Welding Electrodes—Specially designed for welding cast iron to steel or cast iron to cast iron. Clean spatter-free welds! Costs less than other rods for welding cast to steel!

1/8 x 14" (25 lb. box)	lb. 87¢
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TFC Metal Primer — A superior homogenized primer . . . will not lift or bleed. Excellent coverage. Fully rust-inhibitive. Red or Black.

5-gal. cans	$3.15 per gal.
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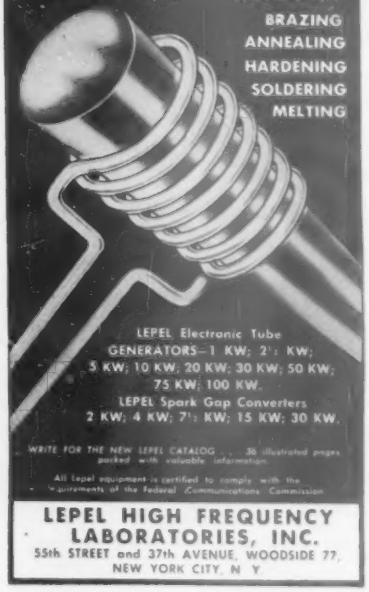

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LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

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THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

Cushman

McCune

Robert Cushman and *W. Alexander McCune Jr.*, will take charge early this month of two new positions in the sales management of the Abrasive Div. of Norton Co., Worcester, Mass. Cushman will be marketing services manager, while McCune will have charge of field sales.

New president of Federal Machine and Welder Co., Warren, Ohio, is *J. R. Barefoot*, replacing *A. S. Blagden*, who was elected to the new post of chairman of the board of directors.

Three men have recently joined Lincoln Electric Co. district offices. They are: *Paul McGonigle*, Boston; *Richard R. Gould*, Pittsburgh; and *Jerry Weiss*, Detroit.

S. John Oechsle, Jr. has been promoted from vice president to executive vice president of Metalweld, Inc., Philadelphia. *Kenneth G. LeFevre*, formerly sales manager of the protective coatings division has been named vice president.

Kenneth H. Meyer succeeds *C. S. Chessman* as director of engineering for C. B. Hunt & Son, Inc. of Salem, Ohio. Meyer joined Hunt in 1954 as assistant chief engineer.

William W. Crawford will serve as director of purchases for U. S. Steel in Pittsburgh, and *Bruce D. Bennett* has been appointed manager of construction material product sales at the firm's Cleveland Steel and Wire Div. He succeeds *Myron E. Capouch*, named assistant general manager of sales for the division.

Gerald M. Henriksen and *Frank P. DeLuca, Jr.* recently joined Acoustica Associates, Inc., Mineola, N. Y., as engineering director and military contracts director respectively.

Olin Mathieson's new Lexington, Mass., sales office will be managed by *Robert W. Pierce*, formerly with the Aluminum Co. of America in Bridgeport, Conn.

Black Beauty

Singer's new lightweight safety clothing and gloves for inert gas arc welding

★Welders gloves and mittens

★ Jackets ★ Sleeves (all types)
★ Bib aprons ★ Split-leg aprons

Safety experts agree this beautiful dull black color is the best protection against the greater threat of ultra-violet rays in inert gas arc welding. The leather is about ONE-HALF the usual weight, specially tanned to make it soft and pliable. This lack of bulk brings amazing comfort.

NEW 16-PAGE CATALOG

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Work Gloves That "Sing"

WE HAVE THE FLUX RIGHT For Your Job

62 years of experience in scientific development in welding

Whatever the particular job you have to do—we have the right FLUXINE you need. Besides our 25 FLUXINES we carry a complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

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FACE SHIELD

Excellent protection for spot welding, grinding, buffing, acid pouring. Fiber forehead shield. Contour headgear. Easy, window replacement without tools.

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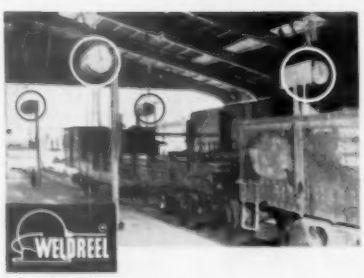

Welding Hose and Cable Reels

SOUTHERN RAILWAY SYSTEM keeps unused welding hose off the floor in their repair facilities at Norris Yard, Birmingham, Alabama, with WELDREEL hose reels.

The banks of WELDREEL units sharply reduce hose replacement—keep working areas clear of unused hose—increase plant safety.

When needed, hose is paid out freely from the WELDREEL reels and locks automatically at length desired. To retract hose, only a slight tug is required to release locking pawls, permitting the powerful springs to rewind hose.

WRITE:

Dr. David Bandel is new associate technical director of *Tracerlab, Inc.*, Waltham, Mass. He replaces *Dr. William Tittle* who accepted a full professorship at Southern Methodist University.

Recent changes in the Lincoln Electric Co.'s district offices have *Bruce N. Frye* transferring to Columbus, Ohio; *Edwin Williams* going to Birmingham, Ala.; and *Gerald R. Stoeckinger* joining the district office in Los Angeles.

Curtiss Howard has been selected advertising and sales promotion manager of the Niles, Ohio, Building Products Div. of American Welding and Manufacturing Co.

The Bonded Abrasives Div. of Carborundum Co., Niagara Falls, N.Y., has assigned six product managers to serve as liaisons between the manufacturing departments and the field sales force. They are: *D. H. Currie, G. S. Eisaman, H. M. Newberry, J. W. Ripple, W. W. Barrett* and *F. J. Miller.*

Dr. David W. Mitchell has joined Foote Mineral Co.'s research and development department as manager of minerals research at Kings Mountain, Pa. *Dr. Justo B. Bravo* is the firm's senior research chemist and *Dr. Meyer M. Markowitz* is project leader at the Chemical Research Division. *Dr. Thomas E. Currie* will specialize in porcelain enamel research.

First vice president of Square D Co., Detroit, is *Lawrence G. Maechtlen.* A director and vice president since 1951, Maechtlen has served as manager of the firm's western division for the past three years. He has been with Square D since 1926. New manager of the western division is *Daniel H. Miller.* He will headquarter at Los Angeles.

William H. Kropp has been appointed district engineer of the Rochester, N. Y., area for Eutectic Welding Alloys Corp., Flushing, N. Y. *Graham J. Kosty* will fill the same position in the eastern Alameda and San Joaquin county sections of California.

Died . . .

Parker B. Francis, chairman of the board of Puritan Compressed Gas Corp., died recently. He was one of the founders of the atmospheric and medical gas industries in the United States.

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a **CONTOUR MARKER** — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

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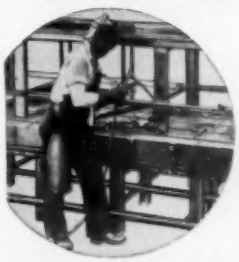

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Precision Welding can offer a savings over other methods of assembly, broaden your operation, cut costs, increase profits. The ideal unit for this type work is the Challenge Precision Welding Table. It's suitable for layout work, "tack" welding and final welding operations. T-slots permit accurate positioning and holding of the work. Made of a special analysis semi-steel, designed to withstand the welding flame or arc. Guaranteed accurate to within .002". Available in three sizes.

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Please send complete information on Challenge Welding Tables and other Precision Surface Equipment.

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free literature . . . . . USE CARD ON PAGE 91

51. HARDFACING—Auto Arc-Weld Mfg. Co. Illustrated sheet describes Magna welder for hard facing or mild steel welding.

52. CONTOUR MARKERS—Contour Marker Corp. NWSA 1020 describes Boyce centering heads, pipe flange aligners, radius markers and contour markers.

53. WIRE BRUSHES—Anderson Corp. "Wire brushes for the welding industry," is title of booklet. Includes wire cup, wire end, spiral twist and hand scratch brushes.

54. FLUX—Anchor Metal Co., Inc. Bulletin No. 56C explains "the right flux for the right job." Includes selection chart.

55. WELD ACCESSORIES—Erico Products, Inc. "Caddy" arc welding accessories are detailed in group of catalog pages. Includes price and parts list, plus bench fixtures, electrode holders, etc.

56. SOLDER—Federated Metals. "Solder, its nature, properties and uses," is title of attractive book. Gives story on solder.

57. FILTER MASK—Welsh Mfg. Co. "Flex-a-foam" filter mask style 1100 is described in bulletin 24. Protects against nontoxic dusts.

58. COPPER—The Beryllium Corp. Casting alloys catalog 223 lists properties of beryllium copper casting alloys, compositions, processing, etc.

59. CLOSURES—Hudson Tool & Die Co., Inc. Leaflet tells of closures used in electronic industry, some are spot welded or silver soldered.

60. SAFETY CLOTHES—Robin W. Adair Co., Inc. Neo-nylon aprons and other protective clothing explained in illustrated page.

61. WALL CHART—All-State Welding Alloys Co., Inc. Designed to aid in selecting alloy and flux for job at hand. Data helpfully arranged.

62. RADIATION SHIELDING—National Lead Co. Interesting booklet explains function of lead in radiation shielding. Includes data, pictures lead bricks.

63. RADIOGRAPHY—Nuclear Systems. Attractive booklet "Gamma radiography" tells of firm's radiography exposure equipment, includes iriditron, multitron, etc.

64. RESPIRATOR—Mine Safety Appliances Co. Page tells of ultra-filter respirator. Weighs only 6 oz.

65. ARC WELDING—Tweco Products Co. Twecolog No. 10 explains products from electrode to machine.

66. TORCH—Velocity Power Tool Co. Bulletin No. 1413-6 covers the propane "Torch-o-matic" soldering torch for burning, brazing, leading, sweating and other jobs.

67. TORCH FILTER—Gibbs Ltd. Page tells of torch filter with "Permetal" bronze elements. Protects hose lines, torches, valves and gages, page declares.

68. SAFETY TORCH—Worcester Taper Pin Co. U-15B liquid fuel metal cutting torch is fully described in booklet.

69. BRAZING—United Wire & Supply Corp. Phamphlet on brazing alloys for steels, nickels, coppers and combinations.

70. WELDERS—Resistance Welder Corp. Pictorial bulletin PTW 5701 on press type welders and tooling illustrates welders and gives examples of special tooling on welded assemblies.

71. BRAZED ASSEMBLIES—Wall Colmonoy Corp. 4-page, 2-color catalog describes facilities and service provided by Wallco division; discusses facilities for design, development and manufacture of copper and silver brazed assemblies.

72. HARDFACING—Union Carbide and Carbon Corp. "Haynes hardfacing electrodes" is 8-page booklet telling of chemical composition, properties, etc. of 12 alloys available as electrodes.

73. SOLDER—Alpha Metals, Inc. Core solder bulletin #456 tells about new rosin-filled solder—includes sample.

74. METALS—American Silver Co. Technical data bulletin CM-901 on clad metals, contact materials and contact assemblies is designed to give reference source for application and purchase of clad metals.

75. HARD CARBIDE—American Platinum Works. Bulletin 542, "Silvaloy brazing of hard carbide," gives joint requirements, brazing process, etc.

76. ELECTRIC BRAKE—Warner Electric Brake & Clutch Co. Technical report WEB 6293 is 36-page illustrated report for design engineers. Includes photographs, drawings, diagrams, selection factors, etc.

77. ULTRASONIC INSPECTION—Speery Products, Inc. Bulletin 50-105 tells of ultrasonic inspection with a reflectoscope.

78. INDUCTION HEATERS—Magnethermic Corp. 60-cycle induction heater bulletin describes latest developments in induction heating of aluminum, copper, brass and steel.

79. TURNTABLES—Merkle-Korff Gear Co. Six models of turntables for industrial and display applications are listed in bulletin 1210A.

80. MAINTENANCE WELDING—Eutectic Welding Alloys Corp. 8-page "Special-Loy" guide pamphlet TIS 2836A gives production and maintenance welding techniques.

81. TORCH—Linde Co. Oxweld W-47, torch able to weld metal from 28 gage sheet to 3 in. plate, described in 8-page booklet. Includes information and performance data on welding heads and cutting nozzles.

82. PROTECTOR—George Walker Co. "Gripmaster" strain reliefs eliminate failure points in your products, leaflet proclaims.

83. FIRE PROTECTION — Johns-Manville Sales Corp. Brochure tells how to use asbestos papers to protect against fire, heat or corrosion.

84. CUTTING UNIT—Wallace Supplies Mfg. Co. Circular describes "Roll-A-Round" cut-machining units; one power operated, the other manually operated.

85. BRAZING—Handy & Harman. Bulletin No. 77 tells of alloys supplied for honeycomb sandwich structure.

86. SILICON RECTIFIER—General Electric Co. Bulletin GEC-1470 lists features and discusses applications of high-current silicon rectifiers. Provides graphic performance data.

87. TUBING—Babcock & Wilcox Co. Bulletin TB-419 explains electric reaistance welded mechanical tubing. Includes information on mechanical properties.

88. GLOVES—Singer Glove Mfg. Co. 16-page catalog shows line of worker's and weldor's gloves.

89. FORMS—Kester Solder Co. Booklet "Solderforms" lists shapes and types . . . rings, discs, pellets, etc.

90. EYE PROTECTION—Sellstrom Mfg. Co. Colorful 28-page catalog features face and eye protection equipment. No. 35 includes goggles, glasses, lenses, welding helmets, etc.

91. AXLE ASSEMBLIES—Hammer Blow Tool Co. 4-page folder illustrates straight, drop and torqueless, single, tandem or triple axles.

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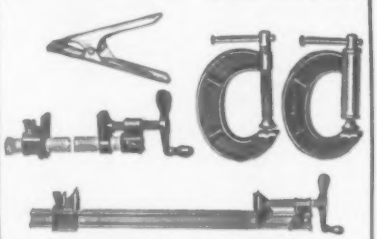
Write for free 32-page complete line catalog



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Leading Manufacturer of welding electrodes is expanding its Research and Development Departments. Interesting position is available requiring experience in metallurgy, chemical analysis and/or coating formulation.

Excellent facilities, stimulating and congenial atmosphere; fine opportunity for right person. He should take an intense interest in his work and be able to get along with people.

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DO YOU WANT TO TRADE?

We will swap any regulator that you send us, provided it has not been stripped of parts or gauges. In return for this trade we will send you a like regulator of the same make and size or one of another equally popular brand. Here is a chance to put into service those old regulators you have lying around. Turn them into useful products for loan equipment or have them on sale as reconditioned regulators. To keep costs down, we are asking all accounts to send checks to cover each transaction with the order. Please do no ask for open terms—this is a special deal. The cash difference between your equipment and ours is $7.50 for a single stage regulator and $8.50 for a two stage. Freight return paid by us. All apparatus is 100% guaranteed to your satisfaction or return to us freight collect. Send us a trial order today.

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Yes, that's right, we repair all makes of Regulators, Cutting & Welding equipment, Radiographs, Radiograph Motors, Machine Torches, & Cutting Tips for dealers. The pricing is handled on a minimum and maximum basis, pre-arranged. Some repaired parts and gauges, especially the type of equipment you handle, can be purchased at our most reasonable prices. So if you care to, you can send the repair parts to us, and we will only charge for the installation. Write for full details today, or better yet, send us a trial order today. You'll really be surprised. Let us be your repair station. We guarantee prompt service.

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WELDING—A profitable trade. Demand for trained men. Learn quickly at best equipped school in U. S. Non-profit. G. I. approved. Catalog free. Write: Hobart Welding School, Box U-182, Troy, Ohio.

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WANTED

AIR COMPRESSOR—4 or 5 Stage—125 or 150 H. P. Synchronous Motor.
ACETYLENE COMPRESSOR—7" x 6" or 8½" x 6" or 9" x 8". Type TR-S3T. 3-Stage Tandem. Preferably Norwalk or Worthington.
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1231 E. Schaaf Rd.
Brooklyn Hgts. 9, Ohio

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Interested in acquiring an established company distributing nationally known welding equipment, gases and supplies. Northern New Jersey location desired. Reply to Box No. 113, C/O Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

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GROUSER BAR
3 sizes
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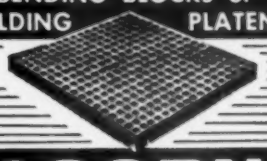

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"PROMPT APPARATUS REPAIR SERVICE"
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HEAVY DUTY TURNING ROLLS

for rotating pressure vessels, pipe and cylindrical bodies for welding

Aronson MACHINE CO., ARCADE, N. Y.

A COMPLETE LINE of WELDING POSITIONERS

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125. Acro Welder Mfg. Co.—Write for further information on welding machinery, engineered and manufactured to order.

126. Adjustable Clamp Co.—32 page catalog on complete line of "Jorgensen" and "Pony" clamps.

127. Aeroprojects Inc.—Write for further information on ultrasonic welding without fusion.

128. Air Reduction Sales Co.—Write for further information on the AIRCO "Easy-arc 30' electrode and also for free samples.

129. Alloy Rods Co.—Complete information on the "Wear-O-Matic" wires and the "Wear-O-Matic" wire feed unit.

130. All-State Welding Alloys Co.—Write for name and address of nearest distributor.

131. Alva Allen Industries—Further information available on heavy duty bench type Allen punch presses.

132. American Brass Co.—Write for a copy of "Publication B-13' for further information on welding with copper.

133. Ampco Metal, Inc.—"Bulletin W-17" available on Ampco-Braz #2 and other Ampco electrodes.

134. Aro Spot Welders Div.—Illustrated literature on the new Aro "Model 410" portable spot welder.

135. Atlas Welding Accessories Co.—Write for further information on the new wood grip weld cleaning tools.

136. Belden Mfg. Co.—Write for further information on Belden's engineered cable.

137. Bernard Welding Equipment Co.—Further information available on the "Short-stub" electrode holders.

138. Burdett Oxygen Co.—Catalog available on the complete line of "Burdox" welding and cutting equipment.

139. The Challenge Machinery Co.—Write for complete information on Challenge welding tables and other precision surface equipment.

140. The Chicago Hardware Foundry Co.—Information on "Fuse-Well" cast-iron welding rods and electrodes.

141. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

142. Contour Marker Corp.—Details on establishing and marking a point at any angle.

143. Drawalloy Corp.—"Bulletin 355-DC" gives complete information on every grade of Drawalloy welding wire.

144. Eutectic Welding Alloys Corp.—For a complete guide to modern welding techniques write for the new 1958, 180 page, pocket welding data book.

145. Fibre-Metal Products Co.—Bulletin No. 49 on "Quick-Lok" welding helmet attachments, and different type welding safety equipment.

146. Flood Safety Products Co.—Data on heat and moisture-resistant "No. 14" fiber glass and "No. P-14" all-plastic ratchet-type helmets.

147. General Electric Co.—Bulletins GEA-6408 (Standardline) and GEA-6593 (Customline) will help you on your next resistance-welding job.

148. Goldsmith Bros.—For further information on low temperature silver brazing write for the GB Data Book.

149. H & M Pipe Beveling Machine Co.—Write for further information on the H & M pipe beveling machines.

150. Harnischfeger Corp.—Write for a detailed description of any type welding machine in the new P&H line.

151. Harrisburg Steel Co.—Further information available on the Harrisburg seamless high pressure gas cylinder.

152. Harris Calorific Co.—Write for further information on Harris' "Portable-Forge" torch No. K-23.

153. Hobart Bros. Co.—Further information available and prices, on the complete line of Hobart's arc welding equipment.

154. Hobart Bros. Co.—Write for further information on the "Rocket 24" electrodes and the new Hobart AC arc welder.

155. Hoeganaes Sponge Iron Corp.—For further information on Hoeganaes-coated iron powder electrodes write for Folder No. 106.

156. Independent Engineering Co., Inc.—Write for further information on transporting compressed gases by gas supply trailors.

157. International Nickel Co., Inc.—A useful illustrated handbook "A Handy Guide to Welding Cast Irons" is available giving tips on welding techniques, increasing machinability, welding heavy sections etc.

158. Jackson Products.—Write for more information on featherlight electrode holders.

159. Krembs & Co.—Sample of "Fluxines" available. State which sample desired.

160. Lenco, Inc.—Write for further information on Hi-Amp electrode holders to fit every manual arc welding requirement.

161. Lepel High Frequency Laboratories, Inc.—Catalog containing information on high-frequency induction heating units for brazing, annealing, hardening, soldering, and melting.

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 70 to 78

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers' bulletins described on these pages, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers and the items that interest you. The New Products section begins on page 70.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

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Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 90)

162. Lincoln Electric Co.—Write for bulletins SB-1364 and SB-1343 on the "Idealarc" ac/dc welder.

163. Linde Co.—Booklet, "Modern Methods of Joining Metals" is available explaining Unionmelt welding and other Linde-developed welding processes.

164. Liquid Carbonic—Complete technical data available on the new CO_2 shielded gas welding.

165. P. R. Mallory & Co.—Write for further information on Mallory's seam welding wheels.

166. Manhattan Rubber Div.—Write for bulletin 7157 on the safety back flared cup.

167. Merrill Brothers—Information on lifting clamps twin and drum lifters, drum tilters and other material-handling devices.

168. Metal & Thermit Corp.—Write for specific information on "Speedex-Triplex" and Folder IP-57 describing the entire "Speedex" iron powder line.

169. Miller Electric Mfg. Co. Inc.—Information on the "Gold Star" electrically controlled welder.

170. National Carbide Co.—Write for name and address of nearest supplier.

171. National Welding Equipment Co.—Write for further information on National's new improved tension screw.

172. Page Steel & Wire Div.—Booklets available "Page Gas Welding Rods" DH-1277 and "Page Submerged Arc and Inert Gas Welding Wire" DH-402A.

173. Rankin Mfg. Co.—Write for your Ranite Select-O-Graph Guide, for picking the right rod for any job without guesswork.

174. Riegel Textile Corp.—Write for further information on Riegel welder's gloves.

175. Ruemelin Mfg. Co.—Bulletin No. 37-E explains how to keep plant air clear of welding fumes.

176. Singer Glove Mfg. Co.—16-page catalog available on Singer's complete line of work gloves and safety clothing.

177. A. O. Smith Corp.—Write for literature on the gas-driven welder.

178. Smith Welding Equipment Corp.—Write for further details on the new air-acetylene torch and the new Handi-Heet" Soldering Torch Kit.

179. Square D Co.—Details on how field engineers are backed by a complete line of performance-proven electrical equipment which puts practical planning into action.

180. Stulz-Sickles Co.—Write for name and address of nearest distributor and further information on "Manganal" bare welding electrodes.

181. Sylvania Electric Products Inc.—Details on complete line of color-coded electrodes for Tig welding.

182. Tempil Corp.—Sample pellets available also booklet, "How Temperatures are Measured."

183. Tennessee Fabricating Co.—Catalog available on 400 casting designs.

184. Thermacote Co.—Write for name and address of nearest distributor.

185. Tillman & Co., John—Catalog available on weldor's gloves and garments.

186. Tube Turns—Stainless Steel Catalog available. Complete information on properties, application, standards, welding procedures and all types of stainless steel fittings and flanges.

187. United Specialties, Inc.—Complete information on "Weldreel" welding hose and cable reels available.

188. Victor Equipment Co.—Information on cutting and welding torches.

189. Westinghouse Electric Corp.—Write for further information on the new "West-Ing-Gun," with its own self-contained wire supply.

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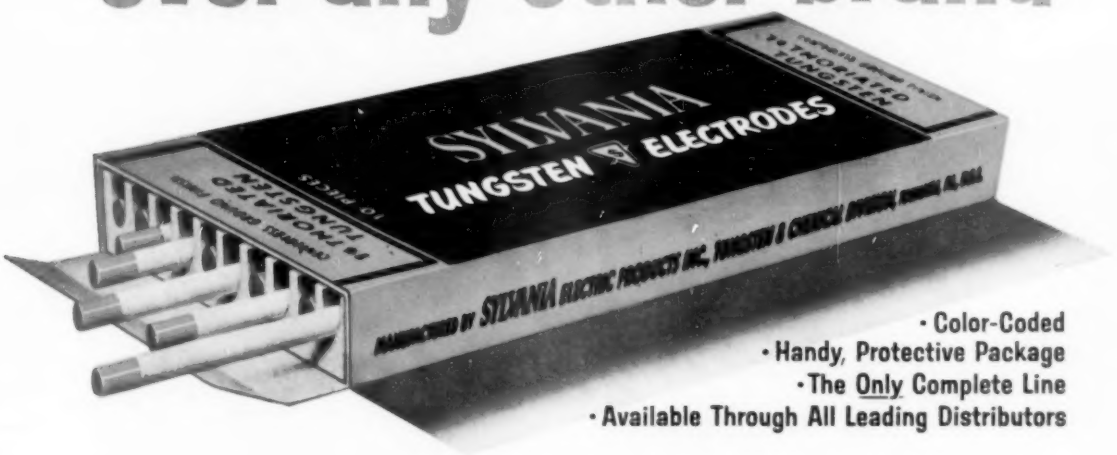
Here's why welders prefer Sylvania Electrodes over any other brand



- Color-Coded
- Handy, Protective Package
- The Only Complete Line
- Available Through All Leading Distributors

EASIEST TO USE—easiest to get—widest range of applications—these are the important reasons why more welders use Sylvania Tungsten Electrodes than any other brand.

It makes sense to use the brand that's packaged for easy handling and color-coded for *positive* identification to reduce shop errors. These important Sylvania *extras* keep electrodes in good condition until you're ready to use them, let you maintain identification through repeated re-uses until electrodes are consumed.

The complete line of Sylvania Electrodes includes 2% thoriated, 1% thoriated, Puretung®, and Zirtung® to cover practically every welding job that comes up. And, for ready availability, Sylvania Electrodes are handled by *all* leading distributors.

• • •

If you're not now using Sylvania Electrodes, it will pay you to place an order with your distributor today.

TUNGSTEN • MOLYBDENUM • CHEMICALS • PHOSPHORS • SEMICONDUCTORS

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
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LIGHTING • RADIO • ELECTRONICS • TELEVISION • METALS & CHEMICALS

WELDING ROD CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Modern methods of welding copper

In the past, most users have had difficulty welding copper because of its high heat conductivity. This has been especially true with oxyacetylene welding which is so slow, costly, and laborious that it often discouraged attempts to weld heavy copper.

PROBLEMS: Arc welding, with its concentrated heat source and high rate of energy input, would minimize the difficulties, and a practicable arc process has long been sought.

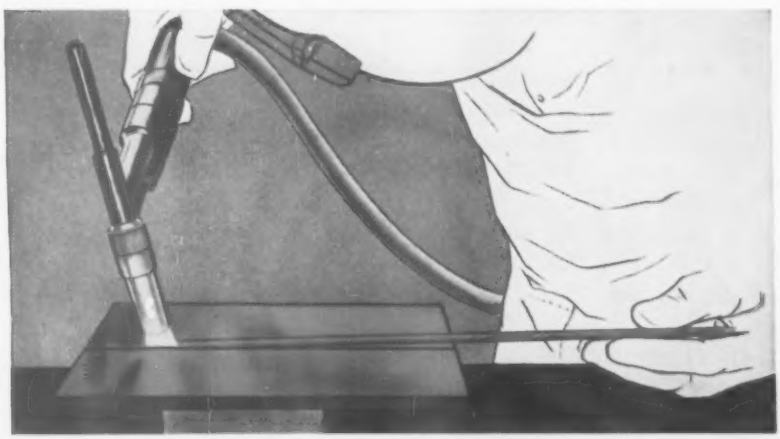
Unfortunately, fluxed electrodes have limited current-carrying capacities and melt with violent and erratic arc action, so that control is poor and spatter loss is high. Preheat levels about 1200°F are usually required to obtain even moderately good performance. Furthermore, most applications on equipment for the chemical industry require weld metal with copper content as high as possible. The usual electrodes which have core wires of copper-tin or copper-silicon alloy are not suitable. Electrodes with copper core wires make welds with high porosity and low mechanical properties.

The other usable method has been the carbon-arc process, but since it offers no protection from the atmosphere it does not produce sound welds with copper filler rods, and the highly alloyed filler metals must be used in order to obtain suitable mechanical properties.

THE SOLUTION: By contrast, the modern inert-gas-shielded-arc processes eliminate the atmosphere as one source of poor weld quality, and offer reasonable welding speeds with only moderate preheat. In addition, it is possible to produce welds of almost pure copper with excellent physical and mechanical properties by using filler metal of Anaconda Copper-372. Countless applications of this filler metal with these processes have demonstrated that arc welds with superior properties are readily attainable.

Anaconda Copper-372 Welding Rod makes welds of exceptional soundness with the highest mechanical properties possible. Welds made with it on Phosphorized Copper meet the requirements of Section VIII of the ASME Boiler and Pressure Vessel Code, and do so without the costly hot-working formerly needed.

Anaconda Copper-372 is widely employed in the production of pressure vessels and other equipment for the chemical and heat-exchanger industries. It is supplied as straight rods for inert-gas-tungsten-arc welding and as coiled wire for the inert-gas-consumable-electrode process. Suggestions for preparation, preheat, shielding gas, etc., are given in Publication B-13. We will gladly send you a copy and answer questions on the welding of copper. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 671m



Inert-gas-tungsten-arc welding of copper plates 3/8" thick with Anaconda Copper-372 Welding Rod, using the forehand position with a slight weave and a short arc. Edges of copper are partially beveled at 45 degrees. Backing is essential, so the edges are beveled only part way and are tightly butted. After welding is done on the beveled side, root is chipped out to sound metal and welded to complete the joint. Finished weld has full strength without peening or annealing.

ANACONDA®
Welding Rods
made by
The American Brass Company